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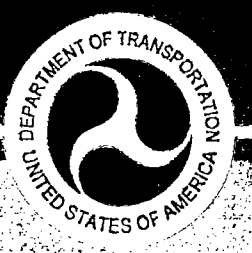


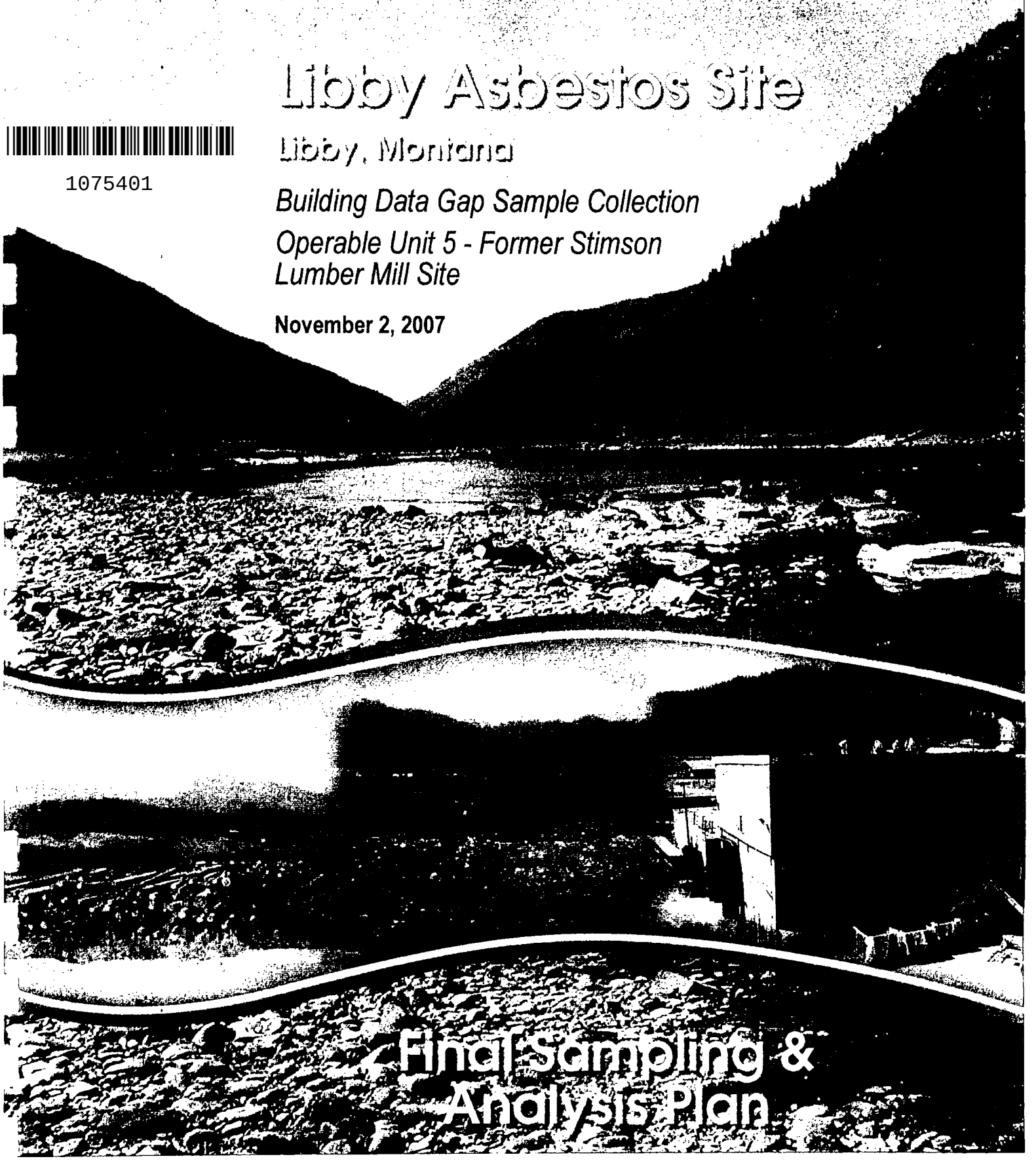
Libby Asbestos Site

Libby, Montana

Building Data Gap Sample Collection

Operable Unit 5 - Former Stimson Lumber Mill Site

November 2, 2007



Final Sampling & Analysis Plan

Final
Sampling and Analysis Plan
Building Data Gap Sample Collection
Operable Unit 5 - Former Stimson Lumber Mill Site
Libby Asbestos Site
Libby, Montana

November 2, 2007

Contract No. DTRT57-05-D-30109
Task Order No. 00006

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Final
Sampling and Analysis Plan
Building Data Gap Sample Collection
Operable Unit 5 - Former Stimson Lumber Mill Site
Libby Asbestos Site
Libby, Montana

November 2, 2007

Contract No. DTRT57-05-D-30109
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Acronyms

AHERA	Asbestos Hazard Emergency Response Act 1986
BNSF	Burlington Northern Santa Fe
CAR	Corrective Action Request
CDM	CDM Federal Programs Corporation
CSHSP	comprehensive site health and safety plan
COC	chain-of-custody
DSR	data summary report
DQOs	data quality objectives
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
ERT	Emergence Response Team
FSDS	field sample data sheet
FSP	field sampling plan
GPS	global positioning system
IDW	investigation-derived waste
ISO	International Organization for Standardization
KDC	Kootenai Development Corporation
L/min	liters per minute
LA	Libby amphibole asbestos
LCPA	Lincoln County Port Authority
MCE	mixed cellulose ester
mm	millimeter
NPL	National Priorities List
OU	operable unit
PM	project manager
PPE	personal protective equipment
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
ROD	record of decision
RPM	remedial project manager
s/cc	structures per cubic centimeter
SAP	sampling and analysis plan
site	former Stimson Lumber Mill site
SOP	standard operating procedure
SWQAPP	site wide quality assurance project plan
TEM	transmission electron microscopy
um	micrometer
Volpe Center	John A. Volpe National Transportation Systems Center

Section 1
Introduction

This document serves as the sampling and analysis plan (SAP) to support sample collection for the assessment of Libby amphibole asbestos (LA) concentrations in air at buildings located within the former Stimson Lumber Mill site (site), operable unit (OU) 5, in Libby, Montana.

In addition to the sampling described in this SAP, soil sampling was recently conducted at areas identified in the initial soils data gap analysis (CDM 2007a). This data gap analysis was used to design a sampling program that was implemented to collect samples from areas that had not been investigated during past sampling events. Details regarding this sampling plan can be found in the *Final Initial Soils Data Gap Sample Collection, SAP, Former Stimson Lumber Mill Site, OU5* (CDM 2007b).

As additional evaluations of data specific to OU5 are completed, additional sampling efforts may be required. If additional sampling efforts are required, SAPs specific to the efforts will be generated prior to sample collection.

This SAP contains all the elements required for both a field sampling plan (FSP) and quality assurance project plan (QAPP). This SAP was developed in accordance with the *Environmental Protection Agency* (EPA) *Requirements for Quality Assurance Project Plans, EPA QA/R-5* (EPA 2001), and the *Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G4* (EPA 2006a). This SAP also incorporates all requirements as specified in the Site-Wide QAPP (SWQAPP) for the Libby Asbestos Project (CDM 2007c).

The purpose of this SAP is to describe the sampling objectives, locations, measurement methods, and data quality objectives (DQOs) for the OU5 building sampling program. The SAP is organized as follows:

Section 1 - Introduction
Section 2 – Site Background
Section 3 – DQOs
Section 4 – Sampling Program
Section 5 – Laboratory Analysis and Requirements
Section 6 – Assessment and Oversight
Section 7 – Data Validation and Usability
Section 8 - References

Appendices

Appendix A	Standard Operating Procedures (SOPs) and Site-Specific Guidance Documents
Appendix B	Field Sample Data Sheets (FSDS)
Appendix C	Libby Asbestos Project Record of Modification Form

Appendix D Site-specific SOP, Analysis of Asbestos in Dustfall Samples by Transmission Electron Microscopy (TEM), Revision 0 (SRC-LIBBY-07)

1.1 Objectives

This section defines the objectives of the building sampling program and the intended use of data.

As determined by previous investigations conducted at the Libby Superfund Site, Libby amphibole asbestos (LA) is present in multiple environmental media in Libby including: indoor air, outdoor ambient air, indoor dust, vermiculite insulation, and soils. As a result, residents of Libby may be exposed to LA, and these exposures may pose a risk of cancer and/or non-cancer effects.

The existing data set for OU5, presented in the OU5 Data Summary Report (DSR) (CDM 2007d), indicates data gaps exist related to the levels of LA present in indoor air specific to current building uses.

Indoor air and dust evaluations have occurred at OU5 in the past, but were specific to the historical use and the past manufacturing processes that occurred in each of the OU5 buildings. These efforts were conducted in accordance with the *Property Specific SAP, Air and Dust Sampling for the Stimson Lumber Company* (CDM 2002a), hereafter referred to as the Stimson Air and Dust SAP (CDM 2002a). This effort was designed to determine any exposures to Stimson employees during their work in the Stimson milling and production processes. Findings of this investigation are summarized in the Draft *Summary Report Revision No.1 for the Former Stimson Lumber Company Area Investigations* (CDM 2005) and the OU5 DSR (CDM 2007d).

Since the 2002 sampling efforts, many buildings have been vacated and all processing and milling equipment have been removed. Additional buildings are currently used by various local businesses for a variety of uses not related to lumber milling. Levels of LA in indoor air have not been evaluated for the current building conditions and uses.

The objective of the sampling program described in this SAP is to collect data of sufficient representativeness and quality to evaluate the level of LA in indoor air at buildings within OU5.

1.2 Project Schedule and Deliverables

Sampling is expected to be conducted in two separate events to gather the required number of samples and determine any temporal variability in LA concentrations. Each building will be sampled as described in Section 4 once between November and December 2007. Once the initial data set, collected as described in this SAP, is evaluated by the EPA risk assessment and management teams, additional data collection may be deemed necessary to support final decision-making specific to OU5.

Section 2
Site Background

This section describes site location, history, and information regarding the site.

2.1 Site Location

The Libby Superfund Site has been subdivided into seven OUs to facilitate a phased approach to cleanup (Figure 2-1):

- OU1. The former export plant is defined geographically by the property boundary of the parcel of land that included the former export plant.

- OU2. The exact geographic area of OU2 has not yet been defined, but includes areas impacted by contamination released from the former Screening Plant. These areas include the former Screening Plant, the Flyway property, the Highway 37 right-of-way adjacent to the former Screening Plant and/or Rainy Creek Road, the Wise property, and the Kootenai Development Corporation (KDC) Bluffs. The KDC Bluffs area is located directly across the Kootenai River from the former Screening Plant.

- OU3. The mine OU includes the former vermiculite mine and the geographic area (including ponds) surrounding the former vermiculite mine that has been impacted by releases from the mine, including Rainy Creek and the Kootenai River. Rainy Creek Road is also included in OU3. The exact geographic area of OU3 has not yet been defined but will be based primarily upon the extent of contamination associated with releases from the former vermiculite mine.

- OU4. OU4 is defined as residential, commercial, industrial (not associated with former W.R. Grace operations), and public properties, including schools and parks in and around the City of Libby, or those which have received material from the mine not associated with W.R. Grace operations. Highway transportation corridors such as Highway 37 (including the five miles of Highway 37 beginning at the intersection of Rainy Creek Road and extending into the town of Libby) are also included in OU4. Portions of Highway 37 associated with the Screening Plant are addressed in OU2 and are therefore excluded from OU4.

- OU5. The former Stimson Lumber Mill is defined geographically by the parcel of land that included the former Stimson Mill.

- OU6. The rail yard owned and operated by the Burlington Northern and Santa Fe Railroad (BNSF) is defined geographically by the BNSF property boundaries and extent of contamination associated with the rail yard. Railroad transportation corridors are also included in this OU.

- OU7. The Troy OU includes all residential, commercial, and public properties within the town of Troy.

OU 5 is situated in the eastern section of Libby, Montana on U.S. Highway 2 South (Figure 2-2). The boundary of OU5 is defined geographically by the parcel of land that included the former Stimson Lumber Company. The eastern boundary of OU 5 follows the western high bank of Libby Creek, and the creek is included in OU 4. The property is approximately 400 acres in size and is occupied by various buildings, processing plants, storage sheds including the central maintenance building, plywood plant, finger joint building, truck barn, office, and others.

Within the boundary of OU 5 exists the Libby Groundwater Superfund Site (Figure 2-3). The Libby Groundwater Superfund Site was placed on the National Priorities List (NPL) in September 1983 due to groundwater contamination resulting from wood preservative processing. Ownership of the remediation units related to the Libby Groundwater Superfund Site has been retained by International Paper. Two Records of Decision (RODs) direct three stages of work agreed to by Champion: an initial action and two long-term phases. The latter phases focus on cleanup of the groundwater, and cleanup of the soil, lower aquifer and source control. Groundwater and soil remediation efforts are currently ongoing.

2.2 Site History

The timber industry was a major foundation of Libby's economy for much of the city's history. The first sawmill was built in the winter of 1891-1892 near the present day downtown Libby. In 1906, the Dawson Lumber Company built a modern saw mill bringing workers and their families to the city in greater numbers. As early as 1914, parcels were bought and sold from private owners to companies such as the Dawson Lumber Company, Libby Lumber Company, and St. Regis Paper Company.

The facility was known as the J. Neils Lumber Company when wood treating began in approximately 1946. St. Regis Corporation purchased the company and facility in 1957 and continued to treat wood until 1969, when the wood treating plant was disassembled. In 1985 Champion International Corporation bought the facility; Champion later sold the mill to Stimson Lumber Company in 1993 and International Paper purchased Champion in 2000. Historical information regarding the Stimson property suggests that vermiculite products were used at, or transported to, the property at various times and at various locations. Additionally, vermiculite insulation was installed in buildings which were used during daily plant operations. It is believed that these products contain varying levels of LA.

In 1993, the Stimson Lumber Company purchased all of the parcels owned by the various private owners to form what is now recognized as the Site boundary. The Site is bounded to the north by the Kootenai River, to the west by Highway 2, to the east by the Kootenai National Forest and to the south by Gruber Road. The parcel of land containing Millwork West, a local lumber distributor, was sold by Stimson to private industries in 1998 and is considered part of OU4.

In 2003 the majority of lumber production activities at the Stimson Lumber Company ceased and the mill property was bought by the Lincoln County Port Authority (LCPA) and subsequently transferred ownership to the Kootenai Business Park

Industrial District which is currently in the process of redeveloping the site. In 2005, LCPA sold the land to the Kootenai Business Park Industrial District. Details regarding the current use of the site can be found in the OU5 DSR (CDM 2007d).

Since 1999, EPA has conducted sampling and cleanup activities to address highly contaminated areas in the Libby Valley. The EPA investigation was initiated in response to published media articles that detailed extensive asbestos-related health problems in the Libby population. While at first the situation was thought to be limited to those with direct or indirect occupational exposures, it soon became clear that there were multiple exposure pathways and many persons with no link to mining-related activities were affected. The site was listed on the Superfund NPL in February 2002.

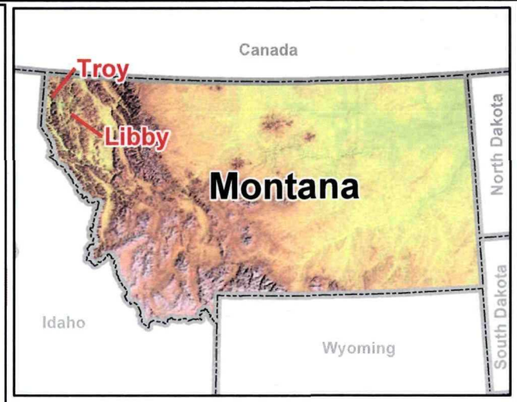
2.3 Summary of Previous Actions

Multiple investigation, pre-removal, and removal events have occurred at the site to date and are summarized in the following table:

Location	Date	Lead Agency/Company	Description	Reference Document
Characterization and Investigation Activities				
Site Interview	2001, September	EPA	Site interview	None available
Former Nursery	2002, May	EPA	Microvacuum sampling in former nursery shed	Property Specific SAP, Air and Dust Sampling for the Stimson Lumber Company (CDM 2002c)*
Site-wide	2002, September	EPA	Building inspection, personal air, stationary air, dust, and soil	Final SAP Addendum for the Stimson Lumber Company Area, Libby Asbestos Site, OU4 (CDM 2002b)* and Property Specific SAP, Air and Dust Sampling for the Stimson Lumber Company (CDM 2002c)*
Bicycle Motocross Track	2004, May	EPA	Soil sampling	Stimson Lumber Additional Sampling – Track/Garden Plots (CDM 2004b)*
Central Maintenance Building	2004, May	EPA	Pre-design Inspection (soil, dust, and bulk sampling)	Draft Final Pre-Design Inspection Activities Work Plan (PDIWP) (CDM 2003)
Proposed Demolition Derby Area	2004, July	EPA	Soil sampling	Investigation Strategy for the Proposed Demolition Derby Plot at the Former Stimson Lumber Site (CDM 2004c)*
Former Nursery	2005, June	EPA	Activity-based sampling	Supplemental Quality Assurance Project Plan (SQAPP) (SRC 2005)
Removal Actions				
Plywood Plant and Truck Shop	1999, November	MCS through Stimson Lumber	Asbestos abatement	None available

Location	Date	Lead Agency/Company	Description	Reference Document
Finger Jointer	2000, May	MCS through Stimson Lumber	Removal of vermiculite insulation from lunch room and bathroom	None available
Dry Kiln Tunnel	2002, December	IRS through Stimson Lumber Company	Removal of pipe insulation and asbestos containing debris	Asbestos Abatement Post Project Record for Stimson Kilns – Libby, IRS Project #5986 (IRS 2002)
Central Maintenance Building	2003, May and June	IRS through Stimson Lumber Company	Removal of vermiculite insulation	Asbestos Abatement Post Project Record for Stimson Libby Truck Building, IRS Project #6267 (IRS 2003a)
Plywood Dryers	2003, August	IRS through Stimson Lumber Company	Removal of vermiculite insulation from walls, floors, and ceilings	Asbestos Abatement Post Project Record for Stimson Dryers – Libby, IRS Project #6267 (IRS 2003b)
Plywood Plant	2003, August	IRS through Stimson Lumber Company	Removal of pipe insulation of northwest corner	
Screening Building	2003, August	IRS through Stimson Lumber Company	Removal of cement asbestos siding and roofing	
Central Maintenance Building	2003, December	IRS through Stimson Lumber Company	Removal and repair of asbestos containing roofing material	Asbestos Abatement Post Project Record for Stimson Truck Shop, IRS Project #6473 (IRS 2003c)
Former Nursery	2004, Fall	EPA	Installation of fence to isolate area	None available
Finger Jointer Lunch Room	2005, February	IRS through Stimson Lumber Company	Removal of vermiculite insulation	Asbestos Abatement Post Project Record for Stimson – Libby Lunch Room II, IRS Project #7125 (IRS 2005)
Central Maintenance Building	2005, Summer	EPA	Removal of vermiculite insulation	Addendum to the Response Action Work Plan for the Former Stimson Central Maintenance Building Commercial Removal Plan (CDM 2004d)

The reader is referred to the OU5 DSR (CDM 2007d) for details regarding the actions listed above.



Legend

- OU1 - Former Export Plant
- OU2 - Former Screening Plant, Flyway Property, Highway 37 right-of-way adjacent to the Screeing Plant, and the KDC Bluffs
- OU3 - Mine site area, Kootenai River, Rainy Creek and Rainy Creek Road
- OU4 - Residential, Commercial, Industrial Properties including Schools and Parks
- OU5 - Former Stimson Lumber Mill
- OU6 - BNSF Railyard, Tracks, and Right -of-way
- OU7 - Troy

N
W E
S

Miles

0 1 2 4

1 inch equals 1.5 miles

Aerial Phota Data Sources

Libby Color Image Source:
CDM 2002
Flight Dates: 10/14/02 to 10/18/02
Aerials flown by Visual Intelligence Systems, Inc.
1505 Highway 6 South
Houston, TX 77077

Gray Scale DOQ Source:
U.S. Geological Survey Digital Orthophoto Quarter-Quadrangles (DOQQ) 28-Jul-95
Seamless Download (http://seamless.usgs.gov/website/seamless/)
EROS Data Center
USGS EROS Data Center
47914 252nd Street
Sioux Falls
South Dakota
57198-0001

Troy Color Image Source:
National Agriculture Imagery Program (NAIP) 2005
Sales Section
USDA Farm Service Agency
Aerial Photography Field Office
2222 West 2300 South
Salt Lake City UT 84119-2020
Tel: 801-975-3503
Fax: 801-975-3532
Email: apfo.sales@slc.usda.gov
Website: http://www.apfo.usda.gov

Note:
The OU boundaries depicted are based on the definitions found in the Libby Asbestos Conceptual Site Model, Revision 19. Because investigation of the nature and extent of contamination continues, the OU boundaries are subject to change. These OU boundaries are current as of August, 2007.

Map Date: 8/31/2007

DRAFT - For Official Use Only

Figure 2-1

Operable Unit (OU) Boundaries
Libby Asbestos Site
Libby, Montana

CDM

P:\2616-LibbyTask Order 0006 - RI-FS Support\Processing Areas\OU5 - Former Stimson Lumber\SAP\Initial Soils Gap SAP\Final\Figures\Figure2-1_CSS_OUMap_11x17size_OU_v7.mxd

Figure 2-2
Former Stimson Lumber, OU5 Location Map

Libby Asbestos Project
Libby, Montana

CDM

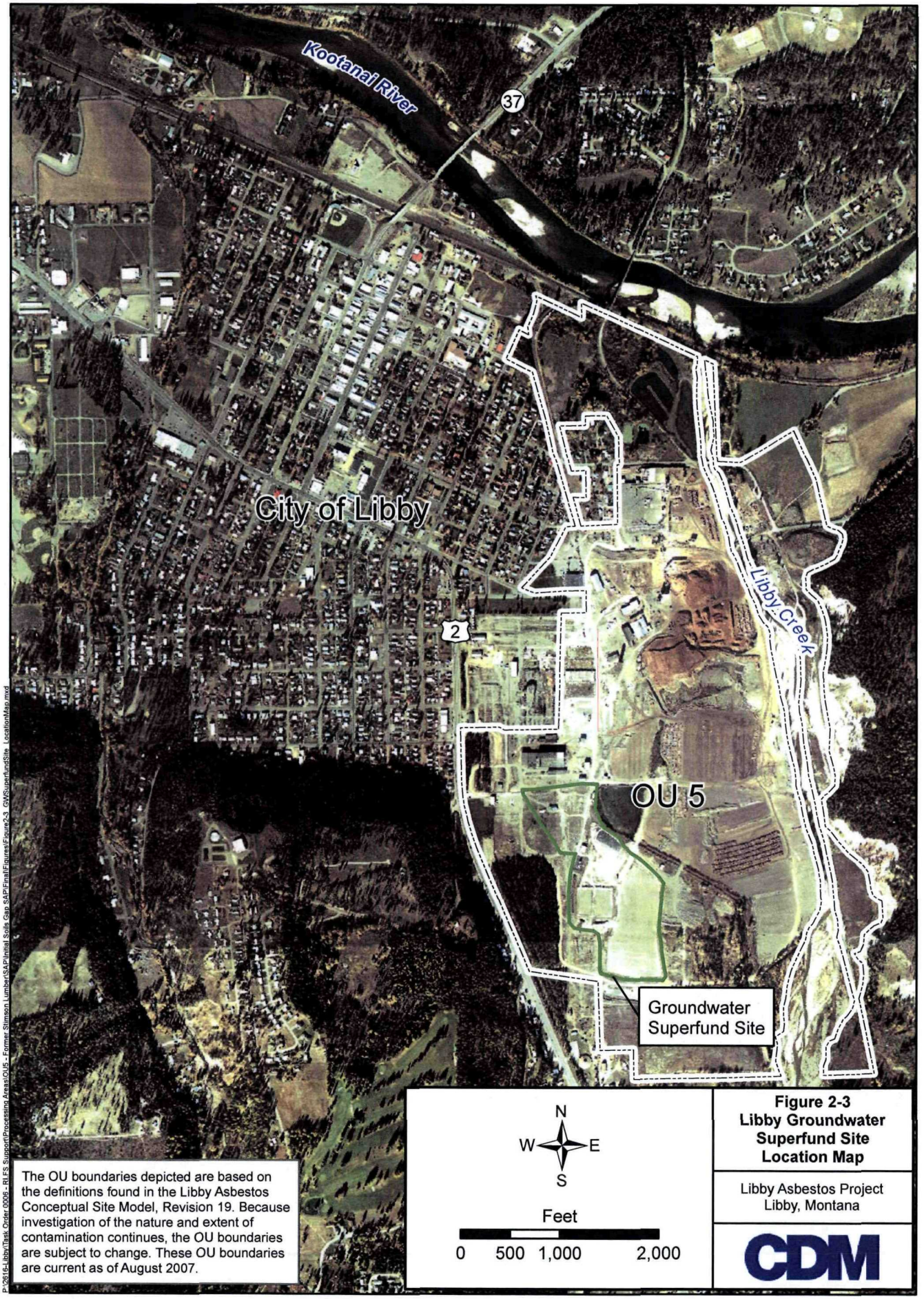


Figure 2-3
Libby Groundwater Superfund Site Location Map

Libby Asbestos Project
Libby, Montana

CDM

Section 3
Data Quality Objectives

The DQO process is a series of planning steps that are designed to ensure that the type, quantity, and quality of environmental data used in decision-making are appropriate for the intended purpose. EPA has issued guidelines to help data users develop site-specific DQOs (EPA 2006a). These guidelines were followed for the development of the DQOs presented in this section.

The DQO process specifies project decisions, the data quality required to support those decisions, specific data types needed, data collection requirements, and analytical techniques necessary to generate the specified data quality. The DQO process consists of seven steps; output from each step influences the choices that will be made later in the process. These steps include:

1. State the problem
2. Identify the decision
3. Identify the inputs to the decision
4. Define the study boundaries
5. Develop a decision rule
6. Specify tolerable limits on decision errors
7. Optimize the design

3.1 Step 1 - State the Problem

The purpose of this step is to describe the problem to be studied so that the focus of the investigation will be unambiguous.

The problem to be addressed in this effort is that evaluation of the protectiveness of cleanup actions at OU5 requires data on the concentration of LA in indoor air at on-site building, but such data are not presently available.

3.2 Step 2 - Identify the Decision

This step identifies what questions the investigation will attempt to resolve and what actions may result.

The decision to be made is whether or not cleanup actions taken to date at OU5 have been successful in reducing LA contamination in current on-site buildings to a level that is health-protective, or whether additional cleanup actions are needed.

Note: In making this decision, it is important to emphasize that the basis for assessing the level of cancer risk from asbestos is currently undergoing Agency review, and the approach may be revised in the future as new methods are developed and as new toxicity data on asbestos are obtained. In addition, EPA has not yet developed a method for assessing non-cancer risks from inhalation exposure to asbestos. Thus, all evaluations of protectiveness that are based on currently available risk assessment methods should be viewed as interim, and these interim decisions may be revised in the future as methods and data for assessing the cancer and non-cancer risks of asbestos are improved.

3.3 Step 3 - Identify the Inputs to the Decision

The purpose of this step is to identify the environmental data that need to be obtained and the measurements that need to be taken to resolve the decision statements.

3.3.1 Indoor Air Data

The chief type of data needed to evaluate health risks to workers at OU5 consists of representative and reliable measures of the concentration of LA in indoor air at current on-site buildings. Experience from other indoor air sampling efforts at Libby has indicated that the most meaningful type of air sample is one collected using a personal air monitor worn by an individual engaged in normal or "high end" activities expected for the building. For convenience, this sampling strategy is referred to as "activity-based sampling" (ABS).

Ideally, EPA would collect ABS samples at all buildings at OU5. However, in buildings that are presently vacant, it is difficult to conduct activities that are certain to be representative of potential future indoor building uses and conditions. Therefore, in vacant buildings, EPA will use an aggressive disturbance (leaf blowers) to simulate the maximum potential future indoor level that might be expected to occur.

3.3.2 Indoor Dust Data

It is expected that the primary source of LA in indoor air in buildings in OU5 is resuspension of contaminated indoor dust. To date, efforts at Libby to establish a quantitative relationship between indoor dust and indoor air have not proved successful, so it is not anticipated that dust measurements can necessarily be used quantitatively in decision-making. However, dust measurements provide a valuable second line of information on LA contamination levels inside buildings, so measures of LA loading (f/cm^2) will be collected using a microvacuum technique to supplement the information obtained from indoor air measures.

3.3.3 Dust Fallout

A third type of data that may be collected to provide information on indoor levels of contamination is the rate at which fallout of airborne fibers onto indoor surfaces occurs ($f/cm^2/hr$). As above, there is presently no method established for utilization

of this type of data in human exposure or risk evaluations, but these data provide a valuable third line in a weight of evidence assessment of indoor contamination.

3.4 Step 4 - Define the Boundaries of the Study

This step specifies the spatial and temporal boundaries of this investigation.

3.4.1 Spatial Bounds

The current sampling effort is restricted to buildings which currently exist within the boundary of OU5 (see Figure 2-2). Attention is focused on buildings that, now or in the future, are suitable for housing regular office space or industrial operations. Buildings such as sheds, open-air buildings, lean-to structures, and other outbuildings which will not house workers on a regular basis are not of primary concern.

Table 3-1 lists the buildings that presently exist within OU5, their current status, and if they will be investigated in this effort.

3.4.2 Temporal Bounds

The buildings will be evaluated for LA based on current use and occupation. Because indoor air levels might tend to vary over time (e.g., seasonally), the ideal data that would be needed are long-term average concentration values of indoor air, which would be collected by repeated sampling over time. However, the focus of this effort is to derive concentration estimates that are "high-end" (conservative), so repeated sampling over time is not needed.

3.5 Step 5 - Develop Decision Rules

Risk from Indoor Air

Ideally, EPA would base cleanup decisions for buildings at OU5 on the total cancer and non-cancer risk experienced by workers at the buildings, including not only exposures that occur at OU5, but also at other locations in Libby. That is, if the cumulative level of risk to workers from exposure to indoor air at buildings at OU5, when combined with the level of risk which applies to the same individuals from other applicable exposure pathways, did not exceed a cancer risk of 1E-04 or a non-cancer Hazard Quotient (HQ) of 1.0, then risks at that building would be considered acceptable. However, quantitative estimates of risk from non-OU5 exposures (e.g., ambient air, exposures in the home, at public areas, etc) are not presently available, and there is no method currently available for quantification of non-cancer risk. For these reasons, EPA will make decisions at OU5 based on a target cancer risk of 1E-05. This value is selected to provide a margin of safety to account for cumulative exposures from non-OU5 sources, as well as for the lack of a method for quantification of non-cancer risks. Based on this, the decision rule is:

> If the level of excess cancer risk to workers from reasonable maximum exposure (RME) to indoor air at buildings at OU5 does not exceed a cancer risk of 1E-05, then risks at that building will be considered acceptable. If the risk exceeds a value of 1E-05, then the building will be considered potentially

unsafe for long-term human use and EPA will assess options for reducing exposure.

The method currently recommended by EPA for quantification of cancer risk is as follows (IRIS 2007):

$$Risk(i) = C(i) \cdot TWF(i) \cdot UR(i)$$

were:

Risk(i) = Risk of dying from a cancer that results as a consequence of exposure from specified exposure scenario "i"

C(i) = Average concentration of asbestos fibers in air (f/cc) during exposure scenario "i"

UR (i) = Unit Risk $(f/cc)^{-1}$ that is appropriate for exposure scenario "i"

TWF(i)= Time weighting factor for exposure scenario "i". This factor accounts for less-than-continuous exposure during the exposure interval.

As noted above, because of limitations in the current methods for assessing risks from asbestos, all decisions regarding residual risk levels are considered interim, and interim decisions may be revisited in the future as new methods and new data become available.

LA in Indoor Dust

As noted above, LA in indoor dust is considered to be a likely source of release of LA into indoor air. Although data are not presently available to support quantitative calculations of the relationship between dust levels and indoor air levels, there is general agreement that LA levels above 5000 f/cm^2 constitute a level of LA contamination that is sufficiently high that additional cleanup is warranted, and this value has been used as clean-up trigger for homes and workplaces in OU4 at Libby. Therefore, a second decision rule is as follows:

> If the measured average level of LA in indoor dust exceeds 5000 f/cm^2, the EPA will take action to reduce the level of LA in indoor dust. If the average level of LA in indoor dust does not exceed 5000 f/cm^2, then no action to reduce indoor dust will be required, unless the level of excess cancer risk to an RME worker exceeds 1E-05 (see above).

3.6 Step 6 - Specify Tolerable Limits on Decision Errors

In making decisions about the long-term average concentration of LA in indoor air and the level of health risk associated with that exposure, two types of decision errors are possible:

- A false negative decision error would occur if a risk manager decides that exposure to LA in indoor air is not of significant health concern, when in fact it is of concern.

- A false positive decision error would occur if a risk manager decides that exposure to LA in indoor air is above a level of concern, when in fact it is not.

EPA is most concerned about guarding against the occurrence of false negative decision errors, since an error of this type may leave humans exposed to unacceptable levels of LA in indoor air. For this reason, it is anticipated that decisions regarding this pathway will be based not only on the best estimate of the long term average concentration, but will also consider the 95% upper confidence limit (UCL) of the long-term average concentration. Use of the UCL to estimate exposure and risk helps account for limitations in the data, and provides a margin of safety in the risk calculations, ensuring that risk estimates are unlikely to be too low. As noted above, other factors that help provide a margin of safety in decision-making include the choice of a target risk level (1E-05) that is 10-fold lower than the value of 1E-04 that EPA usually uses at Superfund sites, and the collection of air samples that represent high-end disturbance activities.

EPA is also concerned with the probability of making false positive decision errors. Although this type of decision error does not result in unacceptable human exposure, it may result in unnecessary expenditure of resources. For the purposes of this effort, the strategy adopted for controlling false positive decision errors is to seek to ensure that, if the exposure estimate based on the 95% UCL is above EPA's level of concern for this pathway, then the UCL is not larger than 3-times the best estimate of the mean. If the 95% UCL is at or above the range that is of potential concern, and the UCL is greater than 3 times the best estimate of the mean, then it will be concluded that there is a substantial probability of a false positive error and that more data may be needed to strengthen decision-making.

3.7 Step 7 - Optimize the Design for Obtaining Data

This step identifies a resource-effective data collection design for generating data that are expected to satisfy the DQOs.

3.7.1 Estimating the Number of Samples

In general, uncertainty around a statistic such as the mean concentration in a building is decreased by the collection of additional samples. However, the relationship between the number of samples and the width of the uncertainty interval may be complex, especially for asbestos samples. If it is assumed that the distribution of concentrations in a set of air samples is likely to be approximately lognormal, then the data set of measurements may be approximated by a Poisson lognormal (PLN) distribution. Statistical procedures are available to estimate the parameters of the underlying lognormal distribution (Haas et al. 1999), and these fitted parameters may be used to compute the UCL of the mean using the approach for lognormal data sets described in EPA 1992. Based on this approach, the ratio of the UCL to the mean of a data set (an indication of the statistical uncertainty in the data) is given by:

$$\frac{UCL}{Mean} = \exp\left(\sigma H / \sqrt{(n-1)}\right)$$

where:

σ = log standard deviation of the measured values
H = statistic described in EPA 1992
n = number of samples

Depending on the value of σ, the number of samples needed to limit uncertainty in the mean may be on the order of 50-80. Assuming that 2-5 samples are collected from each of 13 buildings, this should result in sufficient samples that the UCL value is likely to be in the acceptable range. If between-sample variability is higher than expected, or if the UCL is close to the decision threshold, additional rounds of sampling may be required to minimize the chances of a false positive decision.

3.7.2 Estimating the Required Analytical Sensitivity

For the purposes of this effort, the analytical sensitivity that is needed for analysis of indoor air samples should be sufficient to ensure reliable detection and quantification if risks from activity-based sampling (ABS) air approach or exceed a level of health concern. As noted above, the level of concern selected for decision-making is 1E-05 from indoor workplace air. The first step in selecting the target sensitivity is to compute the concentration of LA in air that would equal a risk of 1E-05, as follows:

$$C(air) = 1E\text{-}05 / (TWF \cdot UR)$$

Note that the type of fibers included in this concentration is defined by the risk model. For example, the current EPA approach is based on phase contrast microscopy (PCM) fibers, which are defined as asbestos fibers longer than 5 um, thicker than 0.25 um, and with an aspect ratio greater than 3:1. For convenience, the fibers used in a risk model are called "risk-based fibers".

In most cases, the risk-based fibers are only a sub-set of the total asbestos fibers present in air. The fraction of fibers that are risk-based is referred to as the "risk-based fraction" (RBF):

$$RBF = C(risk\text{-}based) / C(total)$$

At the Libby site, current analytical methods focus on measuring the concentration of total fibers, and sufficient data have accumulated to estimate the RBF with good accuracy. Thus, the concentration of PCM fibers may be calculated from a measure of total fibers as follows:

$$C(risk\text{-}based) = C(total) \bullet RBF$$

This approach provides an estimate of the concentration of risk-based fibers that has lower statistical uncertainty than if only risk-based fibers were measured, and may be applied to any risk model that may be of interest.

Based on this approach, the concentration of concern of total asbestos associated with a specified risk level (1E-05) is calculated as follows:

$$C(\text{Risk-based}) \text{ (Total TEM s/cc)} = (1E\text{-}05) / (RBF \bullet TWF \bullet UR)$$

Under current land use conditions, buildings at the site are utilized for office space or for light industrial operations, and it is expected that this land use is likely to continue in the future. Based on this, the value of TWF is computed as follows:

$$TWF = 8 \text{ hr}/24 \text{ hr} \cdot 250 \text{ days}/ 365 \text{ days} = 0.23$$

The value of UR depends on the age at first exposure and the duration of exposure. Because the exposed population consists of workers, it is assumed that exposure begins at age 20. In accord with standard Superfund assumptions, it is assumed that exposure duration is 25 years (until age 40). Based on these values, the value of unit risk is:

$$UR = 0.066 \text{ (PCM f/cc)}^{-1}$$

The value of RBF (the fraction of total LA fibers that are PCME fibers) for OU5 is not known, but it is expected to be approximately similar to values that have been observed in air samples collected at other parts of the Libby site:

$$RBF \approx 0.45$$

Based on these inputs, the concentration of total LA in indoor air samples from OU5 that corresponds to a risk of 1E-05 is calculated as:

$$C(\text{air}) \text{ at a risk of } 1E\text{-}05 = (1E\text{-}05) / (0.45 \cdot 0.23 \cdot 0.066) = 0.0015 \text{ f/cc}$$

For this effort, the target sensitivity is set to a value 1/3 that of the risk-based concentration:

$$\text{Sensitivity} = C(\text{air}, 1E\text{-}05) / 3 = 0.0005 \text{ cc}^{-1}$$

The choice of a sensitivity lower than the risk based concentration helps ensure that if the true concentration approached or exceeded the 1E-05 risk level, the number of LA particles observed and counted in air samples would be high enough to quantify the concentration with adequate precision.

Table 3-1. Summary of OU5 Buildings

Building Name*	Building Identification Number	Current Building Status (Occupied/Vacant/Removed/Storage Only)	VCI Historically or Currently (Yes or No)		Current Building Occupants/Use	Number of Employees	Description of Activities	Building Evaluated as Part of SAP Activities	
			Historically	Currently				(Yes or No)	Reason for No Sampling
Central Maintenance Building	BD-002098	Occupied	Yes	Yes - Remnants remain in wall cavities	B&C Packaging	7	Collect and ship landscape rock. Use building as office space and land owned by a private citizen, not contained within OU5, for a rock storage yard.	Yes	N/A
					Columbia Mountain Mechanical	7 to 9	Perform sheet metal work related to heating and air conditioning installation and repair work. Use building as office and storage space.		
					Kootenai Insulation	2 to 3	Install insulation in residential and commercial buildings within OUs 4 and 7. Use building as office and storage space.		
					Thompson Construction	25	Perform excavation and road work within OUs 4 and 7. Use building as office and storage space.		
					A-1-24-7		Maintenance services. Use building as office and storage space.		
					RPO Stone	3	Construct wood pallets/Store Landscape Rock		
					TBC Timber	20	Logging business		
					Westlund Builders	3 to 5	Residential and commercial building contractors performing work within OUs 4 and 7. Use building for office space and storage of supplies and equipment.		
Plywood Plant	BD-002099	Partially Vacant	Yes	No	McLaury Apiaries	1 to 5	Bee keepers store hives inside during the winter	Yes	N/A
			Yes	No	Revett Minerals	185	Uses as a staging area for copper and silver concentrate		
Finger Jointer Plant	BD-002097	Occupied	Yes	No	Stimson Lumber	13	Use building for manufacturing of wood stud products.	No	Previous worker TWA samples will be used for evaluation
Truck Barn	BD-002110	Storage Only	No		Thompson Construction	N/A - shed	Use building for equipment storage.	No	Shed with three walls and a dirt floor
Main Office	BD-002269	Occupied	No		Stimson Lumber	2 to 3	Use building as office space	Yes	N/A
					CDM Federal Programs	10 to 80	Perform work related to environmental consulting for the Libby Asbestos Site. Use building as office space and storage containers in parking lot for equipment storage. Work trailers in the parking lot are used as office space.		
					TipTop Security	10	Provide security services within OU4. Use building as office space.		
Log Yard Break Room	BD-002100	Removed	No		N/A	N/A	N/A	No	Building has been removed
Log Yard Storage Building	BD-002101	Removed	No		N/A	N/A	N/A	No	Building has been removed
Log Yard Oil Storage Shed	BD-002102	Removed	No		N/A	N/A	N/A	No	Building has been removed
Log Yard Pump House	BD-002103	Vacant - equipment remains	No		None	N/A	N/A	Yes	N/A
Log Yard Truck Scale House	BD-002104	Occupied	No		Stimson Lumber/Self Employed Loggers	25 to 30 monthly	Use building to store and maintain computer equipment. Self employed loggers and Stimson personnel access daily, year round.	Yes	N/A
Irrigation Building	BD-002105	Removed	No		N/A	N/A	N/A	No	Building has been removed
Diesel Fire Pump House	BD-002106	Vacant - equipment remains	No		None	N/A	N/A	Yes	N/A
Nursery Area Double Wide Trailer	BD-002107	Partially Demolished	No		N/A	N/A	N/A	No	Building has been removed
Electric Pump House	BD-002108	Storage Only	No		Stimson & KRDC	1 to 2	Storage of pump. Accessed to maintain and service pump equipment.	Yes	N/A
Guard Station at Libby Creek Bridge	BD-002109	Removed	No		N/A	N/A	N/A	No	Building has been removed
Steel Storage	BD-002111	Storage Only	No		All occupants of the former central maintenance building	N/A - shed	All occupants of the former central maintenance building use the building for storage of equipment and supplies.	No	Shed with three walls and a dirt floor
Fire Hall	BD-002112	Occupied	No		Whole 9 Yards	1 to 5	Residential and commercial building contractors performing work within OUs 4 and 7. Use building for office space and storage of supplies and equipment.	Yes	N/A
Wagner Shed	BD-002260	Storage Only	No		Luck E G Post & Rail	13	Use building as storage space for pole and post manufacturing equipment.	No	Shed with three walls and a dirt floor
Electric Motor Shed	BD-002261	Storage Only	No		Stimson & KRDC	1 to 2	Occasional access for maintenance of motor & related equipment.	Yes	N/A
Astrodome	BD-002262	Storage Only	No		Stimson Lumber	N/A - shed	Used to store products from finger jointer before shipment	No	Shed with three walls
Pipe Shop	BD-002263	Storage Only	No		KRDC & A-1 Plumbing	1 to 2	Maintain and store equipment year round	Yes	N/A
Storage and Locomotive Shed	BD-002264	Occupied	No		KRDC & A-1 Plumbing	1 to 2	Access & move rail cars in and out year round	Yes	N/A
Power House Office	BD-002265	Vacant	No		None	N/A	N/A	Yes	N/A
Power House	BD-002266	Vacant	No		None	N/A	N/A	Yes	N/A
Lumber Kilns	BD-002267	Removed	No		N/A	N/A	N/A	No	Building has been removed
Shed 12	BD-002268	Vacant	No		None	N/A	N/A	Yes	N/A

Table 3-1. Summary of OU5 Buildings

Building Name*	Building Identification Number	Current Building Status (Occupied/Vacant/Removed/Storage Only)	VCI Historically or Currently (Yes or No)		Current Building Occupants/Use	Number of Employees	Description of Activities	Building Evaluated as Part of SAP Activities	
			Historically	Currently				(Yes or No)	Reason for No Sampling
Chemical Storage Building	N/A	Vacant	Unknown		Contractors for the Libby Groundwater Superfund Site	1 to 2	Building used to for the storage of chemicals specific to the Libby Groundwater Superfund Site Building is accessed perodically and is not consistanly occupied	Yes	N/A
Intermediate Injection Building	N/A	Vacant	Unknown			1 to 2	Building used to house equipment specific to the Libby Groundwater Superfund Site. Building is accessed perodically and is not consistanly occupied	Yes	N/A
LTU Leachate Building #1	N/A	Vacant	Unknown			1 to 2	Building used for the collection of leachate from LTUs within the Libby Groundwater Superfund Site Building is accessed perodically and is not consistanly occupied	Yes	N/A
LTU Leachate Building #2	N/A	Vacant	Unknown			1 to 2	Building used for the collection of leachate from LTUs within the Libby Groundwater Superfund Site. Building is accessed perodically and is not consistanly occupied.	Yes	N/A
Office/Laboratory		Occupied	Unknown			1 to 2	Building used as an office and a laboratory for the Libby Groundwater Superfund Site	Yes	N/A
Bioreactor Building		Occupied	Unknown			1 to 2	Building is used to store bioreactor equipment for the Libby Groundwater Superfund Site.	Yes	N/A

Notes: KRDC - Kootenai River Development Corporation; N/A - Not applicable

Section 4
Sampling Program

This section summarizes field activities that will be performed during the indoor air sampling efforts specific to buildings located within OU5. This section also provides brief summaries of SOPs and additional site-specific detail that may not be discussed in the SOPs. For additional information, field personnel will refer to the SOPs included in Appendix A. The comprehensive site health and safety program (CDM 2006) should be consulted to determine health and safety protocols for performing site work.

All activities will be performed in accordance with this SAP. Field personnel will also refer to the SWQAPP (CDM 2007c) sections listed below for details regarding requirements referenced in this SAP:

SWQAPP Section Number	Section Title
3.1	Sample Collection
3.2.1	Drafting and Approval of Governing Documents
3.2.2	Field Planning Meetings
3.2.3	Field Team Training Requirements
3.2.4	Field Logbooks
3.2.5	FSDSs
3.2.6	Investigation Specific Field Forms
3.2.7	Photographic Documentation
3.2.8	Global Positioning System (GPS) Point Collection
3.2.9	Field Equipment Maintenance
3.2.10	Handling Investigation Derived Waste (IDW)
3.2.11	Field Sample Custody and Documentation
3.2.12	Sample Packaging and Shipping
3.2.13	Modification Forms
3.2.14.1	Field Surveillances
3.2.14.2	Field Audits

The SOPs and site-specific procedures included in Appendix A are listed below:

- Sample Custody (Modified CDM SOP 1-2)

- Packaging and Shipping of Environmental Samples (Modified CDM SOP 2-1)
- Guide to Handling of IDW (Modified SOP 2-2)
- *Field Logbook Content and Control (Modified CDM SOP 4-1)*
- Photographic Documentation of Field Activities (Modified CDM SOP 4-2)
- Field Equipment Decontamination at Nonradioactive Sites (Modified CDM SOP 4-5)
- Control of Measurement and Test Equipment (CDM SOP 5-1)
- Site-Specific SOP for GPS Coordinate Collection and Handling (CDM-LIBBY-09, Revision 0)
- Site-Specific SOP for 30-Point Composite Microvacuum Dust Sample Collection (CDM-LIBBY-10, Revision 1) with modification
- Sampling of Asbestos Fibers in Air (EPA-LIBBY-01)
- Site-Specific SOP for Passive Collection of Dustfall for Asbestos Analysis (SRC-LIBBY-06, Revision 0)

The following sections are a summary of field activities that will be performed during the performance of the sampling investigation efforts described in this SAP.

4.1 Pre-Sampling Activities

Prior to beginning field activities, a field planning meeting will be conducted, any required trainings will be conducted, and an inventory of equipment and supplies will be performed to determine procurements needs. The following sections discuss these pre-sampling activities.

4.1.1 Field Planning Meeting

A field planning meeting will be conducted in accordance with the procedures detailed in Section 3.2.2 of the SWQAPP (CDM 2007c).

4.1.2 Training Requirements

Training requirements described in Section 3.2.3 of the SWQAPP (CDM 2007c) will apply to personnel conducting sample collection activities described in this SAP.

4.1.3 Inventory and Procurement of Equipment and Supplies

The following equipment will be required for sampling activities, and any required equipment not already contained in the field equipment supply inventory will be procured prior to initiation of sampling activities:

- Field logbooks

- Indelible ink pens
- Digital camera
- Air sample media: 0.8 µm pore, 25 millimeter (mm) diameter mixed cellulose ester (MCE) filter cassettes
- Sample paperwork and sample tags/labels
- Custody seals
- Zipper-top baggies
- Air sampling equipment
- Dust sampling equipment
- Soil sampling equipment
- Personal protective equipment (PPE) as required by the HASP

4.2 Air Sample Collection

This section describes the investigation efforts that will be conducted to meet the objectives of this SAP. Each building will be sampled twice as described in Section 1.2.

4.2.1 Vacant Buildings

During each sampling event, a set of 5 stationary air samples will be collected from each on-site building that is currently vacant of occupants (equipment may remain) and is habitable (contains four exterior walls, a roof, and does not have a soil floor). Thirteen buildings at the site currently fit these criteria (Figure 4-1 shows the location of all on-site buildings):

1) Plywood Plant
2) Log Yard Pump House
3) Diesel Fire Pump House
4) Electric Pump House
5) Electric Motor Shed
6) Pipe Shop
7) Power House
8) Power House Office
9) Shed 12
10) Chemical Storage Building at the Groundwater Superfund Site
11) Intermediate Injection Building at the Groundwater Superfund Site
12) LTU Leachate Building #1 at the Groundwater Superfund Site
13) LTU Leachate Building #2 at the Groundwater Superfund Site

All samples will be collected using a high-end aggressive sampling method. The pump flow rate and time of sample collection listed below were determined to meet

project-specific analytical sensitivity. However, due to the anticipated condition of the building interiors (high level of dust), the field team may change the flow rate or length of sample collection to minimize the chances of overloading the sample. Immediately following sample collection of the first building, the samples will be prepped at the onsite mobile lab to determine if the samples are overloaded.

If overloaded, the first priority will be to try and reach the total volume as listed below by changing flow rate and pump time. If this cannot be obtained, CDM will notify Volpe and EPA management team to discuss alternatives.

The method will be conducted as described below:

1. Set up 5 high-volume stationary air pumps will be calibrated to a flow rate of 10 liters per minute (L/min) with a 0.8 µm pore 25 mm diameter MCE filter cassette at a height of 5 feet above the floor. The exact locations for the air pumps will be determined by field personnel, but should be equally distributed throughout the main floor.

2. Set stationary fans in locations that will not interfere with air sampling equipment. One fan will be used for each 10,000 cubic feet of the building space.

3. All floors, ceilings (that can be reached without using a ladder), and walls will be swept with the exhaust of a minimum one horsepower leaf blower. The leaf blowing activity will last for 5 minutes per 1,000 ft^2 of floor space sampled.

4. Each sampling pump will run for 4 hours (240 minutes). This run time, for a pump calibrated to a flow rate of 10 L/min, results in a target sample volume of 2,400 liters.

5. Each sample cassette will be capped after the 4 hour run time and handled per site protocols.

4.2.2 Occupied Buildings

During each sampling event, personal ABS air samples will be collected from each on-site building that is currently occupied and is habitable (contains four exterior walls, a roof, and does not have a soil floor). Six buildings at the site currently fit these criteria (Figure 4-1 shows the location of all on-site buildings):

1) Central Maintenance Building
2) Main Office
3) Log Yard Truck Scale House
4) Fire Hall
5) Office/Laboratory at the Groundwater Superfund Site
6) Bioreactor Building at the Groundwater Superfund Site

All sampling procedures detailed in *Final SAP for Activity-Based Indoor Air Exposures, Operable Unit 4* (Syracuse Research Corporation [SRC] and CDM 2007e), hereafter refereed to as the Indoor ABS SAP (SRC and CDM 2007) will be followed unless specified below.

4.2.1 Indoor Air Sampling: An ABS activity will be conducted in areas with shared air space. If any of the above listed buildings have areas that have been subdivided into separate rooms and/or offices (i.e., non-shared air spaces), then separate ABS activities will be conducted in each of these areas.

Each ABS activity will be conducted over a 4 hour period. Each 4 hour period will consist of both passive and active type behaviors. The passive and active behaviors will be conducted such that each type of behavior is conducted for roughly half the sampling time. The activities will consist of the following basic sequence of activities but will be modified to reflect the activity types performed by occupants of each building:

Passive Behaviors
Walking between rooms and/or floors
Working at a desk or computer

Active Behaviors
Walking between rooms and/or floors
Dusting a desk or computer
Sweeping or vacuuming a floor

To ensure that each 4-hour sample is spatially representative, each sample shall be collected from multiple rooms on all floors of the building using the method described in the Indoor ABS SAP (SRC and CDM 2007).

During the 4-hour period, two personal air samples will be collected. The flow rates for sample collection will be 10 and 3.5 L/min resulting in target sample volumes of 2,400 and 840 L, respectively.

4.2.3 Outdoor Soil Sampling: Outdoor soil sampling has been completed from the site; therefore additional samples will not be collected as part of this sampling effort.

4.2.4 MET Station Data: As described in the Indoor ABS SAP (SRC and CDM 2007), MET station data will be downloaded from the local NOAA station, LBBM8, each day sampling occurs.

4.3 Dust Sample Collection

Two types of dust samples will be collected to support the requirements detailed in the DOQs in Section 3: microvacuum and settled dust. This section provides information regarding the procedures to be used during the collection of these two types of dust samples.

4.3.1 Microvacuum Dust Sampling

Microvacuum dust samples will be collected in accordance with Site-Specific SOP for 30-Point Composite Microvacuum Dust Sample Collection (CDM-LIBBY-10, Revision 1) (Appendix A) with the following modification:

- 10 composite points will be collected with an optimal ratio of subsample locations of 4 accessible areas, 4 infrequently accessed areas, and 2 inaccessible areas

These samples will be collected from the same rooms where the contractor performs the air sampling activities described in section 4.2. Note that each sample may be collected on multiple cassettes if filter overloading and reduced pump rate is detected. Dust collection shall occur before the start of the first activity period.

4.3.2 Settled Dust Sampling

Settled dust samples will be collected from each of the buildings where air sampling activities are conducted. Settled dust samples will be collected in accordance with Site-Specific SOP for Passive Collection of Dustfall for Asbestos Analysis (SRC-LIBBY-06, Revision 0) (Appendix A) with the following modifications:

- One sample will be collected for each 10,000 ft^2 area on the main floor of the building.

- The settled dust sample will be collected for a 24 hour period beginning within the same hour that air sampling is completed. For example, if air sampling is completed at 3:00pm in a vacant building, the collection of the settled dust sample should begin no later than 4:00pm of the same day. Sample collection will be completed by 4:00pm the following day.

In addition to the sampling described above, EPA is currently considering additional settled dust sampling. The details of any additional settled dust sampling will be included as a modification to this SAP once the details have been determined.

4.4 General Processes

This section describes the general field processes that will be used to support the sampling described in this SAP and includes references to the SWQAPP (CDM 2007c) and investigation-specific modifications to established project procedures when applicable.

4.4.1 Equipment Decontamination

Decontamination of air sampling equipment will be conducted as described in Section 3.1.1.2 of the SWQAPP (CDM 2007c). Air sampling equipment will be wiped with a wet paper towel wetted with distilled water. The towel will be disposed of as IDW.

4.4.2 Sample Labeling and Identification

Samples will be labeled with index identification numbers supplied by field administrative staff, and will be signed out by the sampling teams (i.e., controlled).

For air or dust samples one sample label will be placed on the sampling cassette. The sample identification number will also be written on the outside of the plastic bag used to hold the sampling cassette during transport.

Sample index identification numbers will identify the samples collected during this sampling effort by having the following format:

SL-7####

Where: SL = Stimson Lumber Mill Site

7#### = a sequential five digit number, beginning with 70000 to denote the sampling effort is being conducted in 2007

4.4.3 Field Logbooks

Field logbooks will be completed and managed as described in Section 3.2.4 of the SWQAPP (CDM 2007c). CDM SOP 4-1, Field Logbook Content and Control including project-specific modification is provided in Appendix A. Copies of all logbook entries will be provided to EPA, Volpe, and SRC within one week of collection. Electronic copies are suitable and will be placed in the project e-room within one week after the completion of each sampling event.

4.4.4 FSDSs

FSDSs will be completed and managed as described in Section 3.2.5 of the SWQAPP (CDM 2007c). Appendix B contains copies of the specific FSDSs that will be used to record information for samples collected during the activities described in this SAP. Copies of FSDSs will be provided to EPA, Volpe, and SRC within one week of collection. Electronic copies are suitable and will be placed in the project e-room within one week after the completion of each sampling event.

4.4.5 Photographic Documentation

Photographs will be collected, documented, and managed as described in Section 3.2.7 of the SWQAPP (CDM 2007c). CDM SOP 4-2, Photographic Documentation of Field Activities including project-specific modification is provided in Appendix A. File names will be in the format:

OU5_date , where:

OU5 = Activity completed at OU5

Date = MM_DD_YY

4.4.6 GPS Point Collection

GPS location coordinates will be collected as described in Section 3.2.8 of the SWQAPP (CDM 2007c) and in accordance with CDM-LIBBY-09, provided in Appendix A. For air samples collected as part of this sampling effort the GPS point associated with the samples will be the GPS point assigned to the building in which the samples are collected. Most, if not all, buildings at the site have a pre-existing GPS point collected.

4.4.7 Field Equipment Maintenance

Field equipment maintenance will be conducted and documented as described in Section 3.2.9 of the SWQAPP (CDM 2007c). CDM SOP 5-1, Control of Measurement and Test Equipment, is provided in Appendix A.

4.4.8 Handling IDW

IDW will be managed as described in Section 3.2.10 of the SWQAPP (CDM 2007c). CDM SOP 2-2, Guide to Handling of IDW, including a project-specific modification is provided in Appendix A.

4.4.9 Field Sample Custody and Documentation

Field Sample Custody and documentation will follow the requirements described in Section 3.2.11 of the SWQAPP (CDM 2007c). CDM SOP 1-2, Sample Custody, including a project-specific modification is provided in Appendix A. Copies of all chain-of-custody (COCs) forms will be provided to EPA, Volpe, and SRC within one week of collection. Electronic copies are suitable and will be placed in the project e-room within one week after the completion of each sampling event.

4.4.10 Sample Packaging and Shipping

Sample packaging and shipping will follow the requirements described in Section 3.2.12 of the SWQAPP (CDM 2007c). CDM SOP 2-1, Packaging and Shipping of Environmental Samples, including a project-specific modification is provided in Appendix A.

4.4.11 Modification Documentation

All deviations will be documented and recording according the requirements described in Section 3.2.13 of the SWQAPP (CDM 2007c). A copy of the modification form is provided in Appendix C.

4.4.12 Field Surveillances and Audits

Field surveillances and audits will be conducted according to the requirements described in Section 3.2.14 of the SWQAPP (CDM 2007c).

4.5 Quality Assurance /Quality Control (QA/QC) Activities

The QA/ QC actions required for each process described in this SAP will follow the requirements described in the SWQAPP (CDM 2007c).

Table 4-1 summarizes the collection frequency for QA samples and indicates corrective actions that may be required based on their results.

North Guard Station

Log Yard Storage Shed
Log Yard Oil Shed
Log Yard Break Room
Log Yard Pump House

Libby Creek
Kootenai River
Log Yard Scale House
Nursery Shed
Power House and Power House Office
Irrigation Building
Finger Jointer Processing Plant
Double Wide
Plywood Plant
Shed 12
Main Office/Lab
Chemical Storage
Storage and Locomotive Shed
Diesel Pump House
Electric Pump House
Bioreactor Building
Pipe Shop
Wagner Shed
Astrodome
LTU Leachate Buildings
Electric Motor Shed
Fire Hall
Steel Storage
Abandoned Lumber Kilns
Truck Barn
Intermediate Injection Building
Central Maintenance
U.S. Highway 2
Main Office

The OU boundaries depicted are based on the definitions found in the Libby Asbestos Conceptual Site Model, Revision 19. Because investigation of the nature and extent of contamination continues, the OU boundaries are subject to change. These OU boundaries are current as of August 2007.

Legend

- Buildings
- OU5 Boundary

Text in Blue indicates building is a part of the Libby Groundwater Superfund Site (e.g. Intermediate Injection Building)

N E S W

Feet

0 250 500 1,000

1 inch equals 600 feet

Figure 4-1
Building Locations
Stimson Lumber Company, OU5

Libby Asbestos Project
Libby, Montana

CDM

P:\2616-Libby\Task Order 0006 - RI,FS Support\Processing Areas\OU5 - Former Stimson Lumber\SAP\Building SAP\Final\Figures\Figure4-1_BuildingLocations.mxd

Table 4-1 Summary of Field QC Samples by Media

Media	Sample Type	Minimum Collection Frequency	Minimum Analysis Frequency	Acceptance Criteria	Acceptance Criteria Failure Action
Air	Lot Blank	1 per 500 cassettes	100%	ND for all asbestos	Rejection of all cassettes in lot
	Field Blank	1 per property per day	10% of total collected per week	ND for all asbestos fibers	Analysis of additional field blanks to determine source of potential cross-contamination, qualification of sample results, evaluation of field sample handling procedures
	Co-located	Not Required	0%	NA	Evaluation of sample collection techniques
Dust (microvacuum)	Lot Blank	1 per 300 cassettes	100%	ND for all asbestos	Rejection of all cassettes in lot
	Field Blank	1 per day	10% of total collected per week	ND for all asbestos fibers	Analysis of additional field blanks to determine source of potential cross-contamination, qualification of sample results, evaluation of field sample handling procedures
Dustfall (Settled Dust)	Field Blank	5% of total number of samples collected	100%	ND for all asbestos fibers	Analysis of additional field blanks to determine source of potential cross-contamination, qualification of sample results, evaluation of field sample handling procedures

Notes: QC - quality control; ND - nondetect; RPD - relative percent difference; COC - chain of custody

Section 5
Laboratory Analysis and Requirements

The laboratories used for all sample analysis will have participated in, and acceptably analyzed, the required parameters in the last two proficiency examinations from the National Institute of Standards and Technology/National Voluntary Laboratory Accreditation Program. The laboratory must also analyze project specific performance evaluation samples or other reference materials when requested. These analyses must be performed before any samples are submitted to the laboratory to confirm the laboratory's capabilities and may be subsequently submitted at regular intervals. In addition, the laboratory must participate in the laboratory training program developed by the Libby laboratory team.

5.1 Analytical Methods

This section describes the analytical methods that will be used to analyze samples collected to support this SAP.

All air and microvacuum dust samples collected as part of this effort will be submitted to a subcontracted laboratory for analysis using the International Organization for Standardization (ISO) TEM method 10312, also known as ISO 10312:1995(E) (CDM 2003), with all applicable project specific modifications, including LB-000016, LB-000019, LB-000028, LB-000029, LB-000029a, LB-000030, LB-000053, and LB-000066a (CDM 2003b). All asbestos structures (including not only LA but all other asbestos types as well) that have appropriate diffraction patterns and EDS spectra, and having length greater than or equal to 0.5 um and an aspect ratio ≥ 3:1, will be recorded on the Libby site-specific laboratory data sheets and electronic deliverables.

As described in the latest version of laboratory modification LB-000029, the frequency for laboratory-based QC samples for TEM analysis is:

- Lab blank = 4%
- Recount same = 1%
- Recount different = 2.5%
- Re-preparation = 1%
- Verified analysis = 1%
- Inter-laboratory = 0.5%

All dustfall samples will be analyzed using the procedures detailed in Analysis of Asbestos in Dustfall Samples by TEM (SOP SRC-LIBBY-07, Revision 1) provided in Appendix D, with all applicable project specific modifications, including LB-000016, LB-000019, LB-000028, LB-000029, LB-000029a, LB-000030, LB-000053, and LB-000066a (CDM 2003b). All asbestos structures (including not only LA but all other asbestos types as well) that have appropriate diffraction patterns and EDS spectra, and having

length greater than or equal to 0.5 um and an aspect ratio ≥ 3:1, will be recorded on the Libby site-specific laboratory data sheets and electronic deliverables.

5.2 Analytical Sensitivity

The target analytical sensitivity for all air samples is 0.0005 s/cc. The target analytical sensitivity for microvacuum and dustfall samples is 50 s/cm^2. All air and dust field blanks collected as part of this program will be analyzed by counting a number of grid opens that is approximately equal to the number of grid openings that are analyzed for field samples. Rational for this sensitivity is provided in Section 3.6.

5.3 Holding Times

No preservation requirements or holding times are established for air or microvacuum dust samples collected for asbestos analysis. Settled dust samples should be filtered at the laboratory upon sample receipt to prevent biological growth.

5.4 Laboratory Custody Procedures and Documentation

Laboratory custody procedures and documentation will be completed as required by the specifications detailed in Section 4.5 of the SWQAPP (CDM 2007c).

5.5 Documentation and Records

Laboratory documentation and records will be completed as required by the specifications detailed in Section 4.7 of the SWQAPP (CDM 2007c).

5.6 Data Management

Sample results data will be delivered to the Volpe Center and CDM's Cambridge office both in hard copy and as an electronic data deliverable (EDD) in the most recent project-specific format. Electronic copies of all project deliverables, including graphics, will be filed by project number. Electronic files will be routinely backed up and archived according to individual laboratory processes.

All results, field data sheet information, and survey forms will be maintained in the Libby project database managed by the Volpe Center under the oversight of the Volpe Center database management team.

Section 6
Assessment and Oversight

Assessments and oversight reports to management are necessary to ensure that procedures are followed as required and that deviations from procedures are documented. These reports also serve to keep management current on field activities. Assessment, oversight reports, and response actions are discussed below.

6.1 Assessments

Performance assessments are quantitative checks on the quality of a measurement system and are appropriate to analytical work. Performance assessments for the laboratories may be accomplished by submitting blind reference material (performance evaluation samples). These assessment samples are samples with known concentrations that are submitted to the laboratories without identifying them as such to the laboratories. Laboratory audits may be conducted upon request from the EPA remedial project manager (RPM) or Volpe Center project manager (PM).

Performance samples will be submitted to each laboratory analyzing samples associated with this investigation. The submission frequency is not defined, but may be once every three months.

System assessments are qualitative reviews of different aspects of project work to check on the use of appropriate QC measures and the functioning of the QA system. Project assessments will be performed under the direction of the QA managers, who report directly to the CDM president. Quality Procedure 6.2, as defined in the CDM QA Manual (CDM 2007e), defines CDM 's audit procedures, and requirements. Due to the amount of sampling and the duration of the Libby project, both a field audit and an office audit are scheduled for the Site annually.

6.2 Response Actions

Response actions will be implemented on a case-by-case basis to correct quality problems. Minor response actions taken in the field to immediately correct a quality problem will be documented in the applicable field logbook and a verbal report will be provided to the CDM PM. For verbal reports, the CDM PM will complete a communication log to document the response actions were relayed to him/her. Major response actions taken in the field will be approved by the CDM PM, the EPA RPM, and Volpe PM prior to implementation of the change. Major response actions are those that may affect the quality or objective of the investigation. Quality problems that cannot be corrected quickly through routine procedures may require implementation of a corrective action request (CAR) form.

All formal response actions will be submitted to either CDM 's QA manager and/or project QA coordinator for review and issuance. CDM 's PM or local QA coordinator will notify the QA manager when quality problems arise that may require a formal response action. CAR forms will be completed according to Quality Procedure 8.1 of the CDM QA Manual (CDM 2007e).

In addition, when modifications to this specific SAP are required, either for field or laboratory activities, a Libby Asbestos Project Record of Modification Form (Appendix D) must be completed.

6.3 Reports to Management

QA reports will be provided to management for routine audits and whenever quality problems are encountered. Field staff will note any quality problems on field data sheets, or in field logbooks. CDM 's PM will inform the project QA coordinator upon encountering quality issues that cannot be immediately corrected. Weekly reports and change request forms are not required for this work assignment.

Section 7
Data Validation and Usability

Laboratory results will be reviewed for compliance with project objectives. Data validation and evaluation are discussed in Sections 7.1 and 7.2, respectively.

7.1 Data Review, Validation, and Verification Requirements

Data review, validation, and verification will be performed for important investigative samples as described in the SWQAPP (CDM 2007c). Data validation, review, and verifications must be performed on sample results before distribution to the public for review. Requirements for the frequency of data review are initially set at 10%. This initial rate may be revised as initial samples are analyzed and results evaluated.

Data validation consists of examining the sample data package(s) against pre-determined standardized requirements. The validator may examine, as appropriate, the reported results, QC summaries, case narratives, COC information, raw data, initial and continuing instrument calibration, and other reported information to determine the accuracy and completeness of the data package. During this process, the validator will verify that the analytical methodologies were followed and QC requirements were met. The validator may recalculate selected analytical results to verify the accuracy of the reported information. Analytical results will then be qualified as necessary.

Data verification includes checking that results have been transferred correctly from laboratory data printouts to the laboratory report and to the EDD. Data verification for this project is primarily performed as a function of built-in quality control checks in the Libby project database when data is uploaded. However, the sample coordinator will notify the laboratories and the project database manager (Mr. Mark Raney, Volpe Center) of any discrepancies found during data usage.

7.2 Reconciliation with Data Quality Objectives

Once data has been generated, CDM evaluates data to determine if DQOs were achieved. This achievement will be discussed in the measurement report, including the data and any deviations to this SAP. Sample data will be maintained in the project database (Libby2). Laboratory QC sample data will be stored in hard copy (in the project files) and in Libby2.

Section 8
References

CDM. 2003. Final Sampling and Analysis Plan, Remedial Investigation, Libby Asbestos Site, Operable Unit 4. May 16.

_____. 2006. Comprehensive Site Health and Safety Program, Libby, Montana, Revision 5. December.

_____. 2007a. Initial Soils Data Gap Analysis, Former Stimson Limber Mill, Operable Unit 5.

_____. 2007b. Final Initial Soils Data Gap Sample Collection, Operable Unit 5, Former Stimson Lumber Mill Site.

_____. 2007c. Site-Wide Quality Assurance Project Plan. Final date pending EPA review.

_____. 2007d. Final Data Summary Report, Operable Unit 5, Libby Asbestos Site, Libby, Montana. October 16.

_____. 2007e. Quality Assurance Manual, Revision 11. March.

EPA. 2001. EPA Requirements for Quality Assurance Project Plans, QA/R-5. Final. March.

_____. 2003a. Libby Asbestos Site, Residential/Commercial Cleanup Action Level and Clearance Criteria, Technical Memorandum. Draft Final. December 15.

_____. 2003b. Quality Assurance Project Plan, Performance Evaluation Study for Analytical Methods for Asbestos in Soil, Part B, Revision 1, Preparation of Performance Evaluation Samples. January 24.

_____. 2003c. Quality Assurance Project Plan for the Asbestos in Soil Performance Evaluation Study, Part C, Round-Robin Analysis of Performance Evaluation Samples. April.

_____. 2006. Guidance on Systematic Planning Using the Data Quality Objective Process, QA/G-4. February.

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Appendix A
Standard Operating Procedures and Site-Specific Guidance Documents

Project-Specific Modification

SOP No.: 1-2

SOP Title: Sample Custody

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/12/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

NOTE: Each media (soil/dust) must be submitted on separate COC forms.

The sample coordinator assistant will use the FSDS to complete an electronic chain of custody (eCOC). The sample coordinator will check the data entered to create the eCOC against the FSDSs. Three paper copies of the eCOC will then be generated. One copy will be filed in the CDM Libby office and the other two will be sent with the samples. The sample coordinator will then check the eCOC versus the sample containers and sample shipment. The sample coordinator will be responsible for shipment of samples. If any errors are found on an eCOC after shipment, the paper copy of the COC will be corrected by the sample coordinator with a single strikeout initial and date. The corrected copy will be faxed to Volpe and the laboratory. The fax to Volpe will be used to update the Libby project database.

Reason for and duration of modification: Sample custody procedures for the Libby asbestos project vary slightly from SOP 1-2. These modifications are necessary for the entire duration of the project.

Project-Specific Modification

Via: Hand delivery or shipped. Hand delivery refers to samples delivered by hand to the onsite laboratory; shipped refers to samples sent to the laboratory by delivery service (i.e., Federal Express). To be completed by the sample coordinator.

Project: All samples collected in accordance with this sampling and analysis plan (SAP) are part of the CSS. Circle CSS. To be completed by the field team.

Sample Placed in Cooler/Bag: Refers to visual confirmation of the sample in the shipping container. To be completed by the sample coordinator.

Index ID: Unique index identification number used to identify sample, in the form CSS-#####. To be completed by the field team.

Sample Date: The date each sample was collected, in the form MM/DD/YY. To be completed by the field team.

Sample Time: The time each sample was collected, in military time. To be completed by the field team.

Sample Matrix: The matrix of each sample collected, specific to the CSS; S = soil and W = water. To be completed by the field team.

Sample Type: Sample type of each sample collected; G = grab, C = composite. To be completed by the field team.

Volume: Specific to air and dust samples. Does not pertain to the CSS. "NA" should be placed in this field. To be completed by the field team.

Analysis Request: Analysis of each sample collected. All soil samples will be analyzed by IR. IR will be written in the analysis request portion of the COC form by the field team. The sample coordinator and/or laboratory coordinator may request SEM analysis based on Table 5-2 of the SAP. The sample coordinator and/or laboratory coordinator will designate IR for the appropriate samples.

Comments: Any pertinent information regarding the sample (i.e., vermiculite visible) will be entered by either the field team or the sample coordinator.

Sample Received by Lab: To be checked by the sample custodian at the laboratory upon receipt of the samples to confirm presence of each sample on the COC record.

Project-Specific Modification

Total Number of Samples: Total number of samples on the COC form. To be completed by the field team.

Additional Comments: Any additional comments that relate to samples on the COC form (i.e., turn around times). To be completed by the field team or sample coordinator.

Relinquished by: (1) Signed by field team member that relinquishes samples to sample coordinator and company of person relinquishing samples to sample coordinator (i.e., CDM). Date of relinquish shall be in the form MM/DD/YY and time shall be in military time. (2) Additional relinquished by lines to be completed following standard sample custody procedures.

Received by: (1) Signed by sample coordinator that receives samples from the sampling team and company of person accepting samples from the field teams (i.e., CDM). Date and time of acceptance should be the same as date and time of relinquish. (2) Additional received by lines to be completed following standard sample custody procedures.

Sample Condition upon Receipt: Will reflect the condition of samples at the relinquish time (i.e., accept ok or not acceptable with an explanation). To be completed by the person receiving samples.

Page ___ of ___: Sequential page number of the entire COC set sent to the laboratory. To be completed by the sample coordinator.

Sample Custody

SOP 1-2
Revision: 5
Date: March 2007

Prepared: David O. Johnson

Technical Review: S. Budney

E-Signed by Michael C. Malloy
VERIFY authenticity with ApproveIt

QA Review: Jo Nell Mullins

Approved:

Signature/Date

E-Signed by P. Michael Schwan
VERIFY authenticity with ApproveIt

Issued:

Signature/Date

1.0 Objective

Because of the evidentiary nature of samples collected during environmental investigations, possession must be traceable from the time the samples are collected until their derived data are introduced as evidence in legal proceedings. To maintain and document sample possession, sample custody procedures are followed. All paperwork associated with the sample custody procedures will be retained in CDM Federal Programs Corporation (CDM) files unless the client requests that it be transferred to them for use in legal proceedings or at the completion of the contract.

Note: Sample custody documentation requirements vary with the specific EPA region or client. This SOP is intended to present basic sample custody requirements, along with common options. Specific sample custody requirements shall be presented in the project-specific quality assurance (QA) project plan or project-specific modification or clarification form (see Section U-1).

2.0 Background

2.1 *Definitions*

Sample - A sample is material to be analyzed that is contained in single or multiple containers representing a unique sample identification number.

Sample Custody - A sample is under custody if:

1. It is in your possession
2. It is in your view, after being in your possession
3. It was in your possession and you locked it up
4. It is in a designated secure area

Chain-of-Custody Record - A chain-of-custody record is a form used to document the transfer of custody of samples from one individual to another.

Custody Seal - A custody seal is a tape-like seal that is part of the chain-of-custody process and is used to detect tampering with samples after they have been packed for shipping.

Sample Label - A sample label is an adhesive label placed on sample containers to designate a sample identification number and other sampling information.

Sample Tag - A sample tag is attached with string to a sample container to designate a sample identification number and other sampling information. Tags may be used when it is difficult to physically place adhesive labels on the container (e.g., in the case of small air sampling tubes).

3.0 General Responsibilities

Sampler - The sampler is personally responsible for the care and custody of the samples collected until they are properly transferred or dispatched.

Field Team Leader - The field team leader (FTL) is responsible for ensuring that strict chain-of-custody procedures are maintained during all sampling events. The FTL is also responsible for coordinating with the subcontractor laboratory to

ensure that adequate information is recorded on custody records. The FTL determines whether proper custody procedures were followed during the fieldwork.

Field Sample Custodian - The field sample custodian, when designated by the FTL, is responsible for accepting custody of samples from the sampler(s) and properly packing and shipping the samples to the laboratory assigned to do the analyses. A field sample custodian is typically designated only for large and complex field efforts.

Note: Responsibilities may vary from site to site. Therefore, all field team member responsibilities shall be defined in the field plan or site/quality assurance project plan (QAPP).

4.0 Required Supplies

- Chain-of-custody records (applicable client or CDM forms)
- Sample labels and/or tags
- EPA Field Operations Records Management System II Lite™ (FORMS II Lite™) software (if required)
- Printer paper
- Custody seals
- Clear tape
- Computer
- Printer

5.0 Procedures

5.1 Chain-of-Custody Record

This procedure establishes a method for maintaining custody of samples through use of a chain-of-custody record. This procedure will be followed for all samples collected or split samples accepted.

Field Custody

1. Collect only the number of samples needed to represent the media being sampled. To the extent possible, determine the quantity and types of samples and sample locations before the actual fieldwork. As few people as possible shall handle samples.

2. Complete sample labels or tags for each sample using waterproof ink.

3. Maintain personal custody of the samples (in your possession) at all times until custody is transferred for sample shipment or directly to the analytical laboratory.

Transfer of Custody and Shipment

1. Complete a chain-of-custody record for all samples (see Figure 1 for an example of a chain-of-custody record. Similar forms may be used when requested by the client). When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents sample custody transfer from the sampler, often through another person, to the sample custodian in the appropriate laboratory.

    - The date/time will be the same for both signatures when custody is transferred directly to another person. When samples are shipped via common carrier (e.g., Federal Express), the date/time will not be the same for both signatures. Common carriers are not required to sign the chain-of-custody record.

    - In all cases, it must be readily apparent that the person who received custody is the same person who relinquished custody to the next custodian.

    - If samples are left unattended or a person refuses to sign, this must be documented and explained on the chain-of-custody record.

Note: If a field sample custodian has been designated, he/she may initiate the chain-of-custody record, sign, and date as the relinquisher. The individual sampler(s) must sign in the appropriate block, but does (do) not need to sign and date as a relinquisher (refer to Figure 1).

2. Package samples properly for shipment and dispatch to the appropriate laboratory for analysis. Each shipment must be accompanied by a separate chain-of-custody record. If a shipment consists of multiple coolers, a chain-of-custody record shall be filled out for each cooler documenting only samples contained in that particular cooler.

3. The original record will accompany the shipment, and the copies will be retained by the FTL and, if applicable, distributed to the appropriate sample coordinators. Freight bills will also be retained by the FTL as part of the permanent documentation. The shipping number from the freight bill shall be recorded on the applicable chain-of-custody record and field logbook in accordance with TSOP 4-1, *Field Logbook Content and Control.*

Procedure for Completing CDM Example Chain-of-Custody Record

The following procedure is to be used to fill out the CDM chain-of-custody record. The record provided herein (Figure 1) is an example chain-of-custody record. If another type of custody record (i.e., provided by the EPA Contract Laboratory Program (CLP) or a subcontract laboratory or generated by FORMS II Lite™) is used to track the custody of samples, the custody record shall be filled out in its entirety.

1. Record project number.
2. Record FTL for the project (if a field sample custodian has been designated, also record this name in the "Remarks" box).
3. Record the name and address of the laboratory to which samples are being shipped.
4. Enter the project name/location or code number.
5. Record overnight courier's airbill number.
6. Record sample location number.
7. Record sample number.
8. Note preservatives added to the sample.
9. Note media type (matrix) of the sample.
10. Note sample type (grab or composite).
11. Enter date of sample collection.
12. Enter time of sample collection in military time.
13. When required by the client, enter the names or initials of the samplers next to the sample location number of the sample they collected.
14. List parameters for analysis and the number of containers submitted for each analysis.
15. Enter appropriate designation for laboratory quality control (e.g., matrix spike/matrix spike duplicate [MS/MSD], matrix spike/duplicate [MS/D]), or other remarks (e.g., sample depth).
16. Sign the chain-of-custody record(s) in the space provided. All samplers must sign each record.
17. If sample tags are used, record the sample tag number in the "Remarks" column.
18. The originator checks information entered in Items 1 through 16 and then signs the top left "Relinquished by" box, prints his/her name, and enters the current date and time (military).
19. Send the top two copies (usually white and yellow) with the samples to the laboratory; retain the third copy (usually pink) for the project files. Retain additional copies for the project file or distribute as required to the appropriate sample coordinators.
20. The laboratory sample custodian receiving the sample shipment checks the sample label information against the chain-of-custody record. Sample condition is checked and anything unusual is noted under "Remarks" on the chain-of-custody record. The laboratory custodian receiving custody signs in the adjacent "Received by" box and keeps the copy. The white copy is returned to CDM.

5.2 Sample Labels and Tags

Unless the client directs otherwise, sample labels or tags will be used for all samples collected or accepted for CDM projects.

1. Complete one label or tag with the information required by the client for each sample container collected. A typical label or tag would be completed as follows (see Figure 2 for example of sample tag; labels are completed with the equivalent information):

   - Record the project code (i.e., project or task number).
   - Enter the station number (sample number or EPA CLP identification number) if applicable.
   - Record the date to indicate the month, day, and year of sample collection.
   - Enter the time (military) of sample collection.

- Place a check to indicate composite or grab sample.
- Record the station (sample) location.
- Sign in the space provided.
- Place a check next to "yes" or "no" to indicate if a preservative was added.
- Place a check under "Analyses" next to the parameters for which the sample is to be analyzed. If the desired analysis is not listed, write it in the empty slot. Note: Do not write in the box for "laboratory sample number."
- Place or write additional relevant information under "Remarks."

2. Place adhesive labels directly on the sample containers. Place clear tape over the label to protect from moisture.

3. Securely attach sample tags to the sample bottle. On 2.27 liter (80 oz.) amber bottles, the tag string may be looped through the ring-style handle and tied. On all other containers, it is recommended that the string be looped around the neck of the bottle, then twisted, and relooped around the neck until the slack in the string is removed.

4. Double-check that the information recorded on the sample tag is consistent with the information recorded on the chain-of-custody record.

5.3 Custody Seals

Two custody seals must be placed on opposite corners of all shipping containers (e.g., cooler) before shipment. The seals shall be signed and dated by the shipper.

Custody seals may also be required to be placed on individual sample bottles. Check with the client or refer to EPA regional guidelines for direction.

5.4 Sample Shipping

CDM Federal SOP 2-1, *Packaging and Shipping Environmental Samples* defines the requirements for packaging and shipping environmental samples.

6.0 Restrictions/Limitations

Check with the EPA region or client for specific guidelines. If no specific guidelines are identified, this procedure shall be followed.

For EPA CLP sampling events, combined chain-of-custody/traffic report forms generated with EPA FORMS II Lite™ or other EPA-specific records may be used. Refer to regional guidelines for completing these forms.

The EPA FORMS II Lite™ software may be used to customize sample labels and custody records when directed by the client or the CDM project manager.

7.0 References

U. S. Army Corps of Engineers. 2001. *Requirements for the Preparation of Sampling and Analysis Plan*, EM 200-1-3. Appendix F. February.

U. S. Environmental Protection Agency. Revised March 1992. *National Enforcement Investigations Center, Multi-Media Investigation Manual*, EPA-330/9-89-003-R. p.85.

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_____. 2004. *Contract Laboratory Program (CLP), Guidance for Field Samplers*, EPA-540-R-00-003. Final. Section 3.2. August.

Figure 1
Example CDM Chain-of-Custody Record

CDM

125 Maiden Lane, 5th Floor
New York, NY 10038
(212) 785-9123
Fax: (212) 785-6114

CHAIN OF CUSTODY RECORD

PROJECT ID.	FIELD TEAM LEADER	LABORATORY AND ADDRESS	DATE SHIPPED
PROJECT NAME/LOCATION		LAB CONTRACT:	AIRBILL NO.

MEDIA TYPE
1. Surface Water
2. Groundwater
3. Leachate
4. Field QC
5. Soil/Sediment
6. Oil
7. Waste
8. Other _____

PRESERVATIVES
1. HCl, pH <2
2. HNO3, pH <2
3. NaOH, pH >12
4. H2SO4, pH <2
5. Zinc Acetate, pH >9
6. Ice Only
7. Not Preserved
8. Other _____

SAMPLE TYPE
G = Grab
C = Composite

SAMPLE LOCATION NO.	LABORATORY SAMPLE NUMBER	PRESERVATIVES ADDED	MEDIA TYPE	SAMPLE TYPE	20__ DATE	TIME SAMPLED	ANALYSES (List no. of containers submitted)								REMARKS (Note if MS/MSD)
1.															
2.															
3.															
4.															
5.															
6.															
7.															
8.															
9.															
10.															

SAMPLER SIGNATURES:

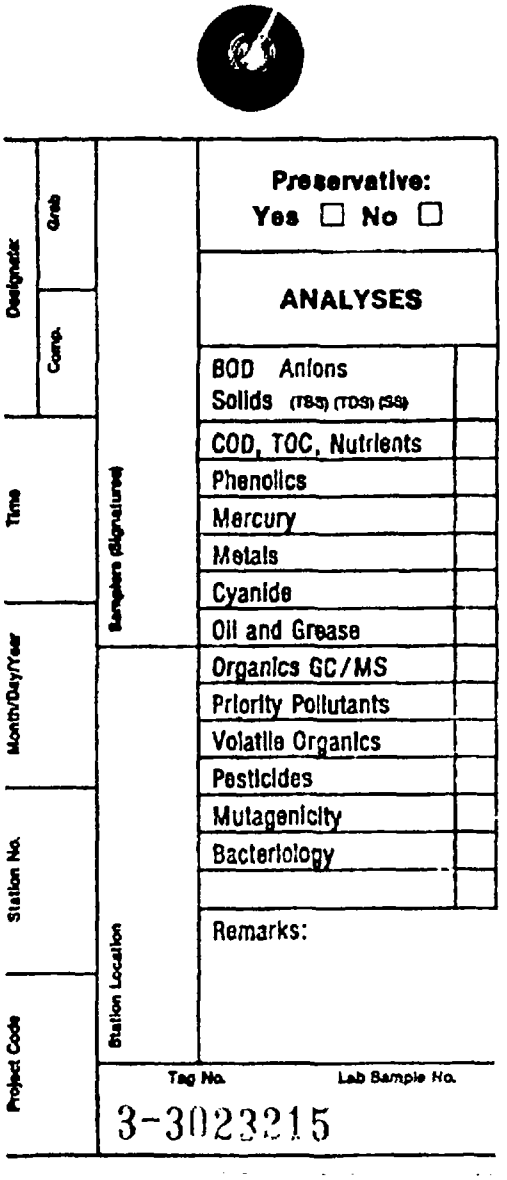
RELINQUISHED BY: (print)	DATE/TIME	RECEIVED BY: (print)	DATE/TIME	RELINQUISHED BY: (print)	DATE/TIME	RECEIVED BY (print)	DATE/TIME
(sign)		(sign)		(sign)		(sign)	
RELINQUISHED BY: (print)	DATE/TIME	RECEIVED BY: (print)	DATE/TIME	RELINQUISHED BY: (print)	DATE/TIME	RECEIVED BY (print)	DATE/TIME
(sign)		(sign)		(sign)		(sign)	

COMMENTS:

DISTRIBUTION: White and yellow copies accompany sample shipment to laboratory; yellow copy returned by laboratory; Pink copy retained by samplers. 1.NB

Note: If requested by the client, different chain-of-custody records may be used. Copies of the template for this record may be obtained from the Chantilly Graphics Department.

Figure 2
Example Sample Tag



Note: Equivalent sample labels or tags may be used.

Project-Specific Modification

SOP No.: 2-1

SOP Title: Packaging and Shipping of Environmental Samples

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/7/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Procedures for shipping environmental samples for the Libby asbestos project vary slightly from CDM Technical SOP 2-1. These modifications are necessary for the entire duration of the project.

Samples collected during this investigation will be packaged and shipped in accordance with CDM Technical SOP 2-1, with the following modifications:

Section 1.4, Required Equipment - Vermiculite (or other absorbent material), bubble wrap, or ice will not be used for packaging or shipping samples.

Section 1.5, Procedures - No vermiculite or other absorbent material will be used to pack the samples. No ice will be used.

Packaging and Shipping Environmental Samples

SOP 2-1
Revision: 3
Date: March 2007

Prepared: Krista Lippoldt

Technical Review: Chuck Myers

E-Signed by Michael C. Malloy
VERIFY authenticity with ApproveIt

QA Review: Jo Nell Mullins

E-Signed by P. Michael Schwan
VERIFY authenticity with ApproveIt

Approved: *Signature/Date*

Issued: *Signature/Date*

1.0 Objective

The objective of this SOP is to outline the requirements for the packaging and shipment of environmental samples. Additionally, Sections 2.0 through 7.0 outline requirements for the packaging and shipping of regulated environmental samples under the Department of Transportation (DOT) Hazardous Materials Regulations, the International Air Transportation Association (IATA), and International Civil Aviation Organization (ICAO) Dangerous Goods Regulations for shipment by air and applies only to domestic shipments. This SOP does not cover the requirements for packaging and shipment of equipment (including data loggers and self-contained breathing apparatus [SCBAs] or bulk chemicals that are regulated under the DOT, IATA, and ICAO.

1.1 Packaging and Shipping of All Samples

This standard operating procedure (SOP) applies to the packaging and shipping of all environmental samples. If the sample is preserved or radioactive, the following sections may also be applicable.

Section 2.0 - Packaging and Shipping Samples Preserved with Methanol
Section 3.0 - Packaging and Shipping Samples Preserved with Sodium Hydroxide
Section 4.0 - Packaging and Shipping Samples Preserved with Hydrochloric Acid
Section 5.0 - Packaging and Shipping Samples Preserved with Nitric Acid
Section 6.0 - Packaging and Shipping Samples Preserved with Sulfuric Acid
Section 7.0 - Packaging and Shipping Limited-Quantity Radioactive Samples

1.2 Background

1.2.1 Definitions

Environmental Sample - An aliquot of air, water, plant material, sediment, or soil that represents the contaminant levels on a site. Samples of potential contaminant sources, like tanks, lagoons, or non-aqueous phase liquids are normally not "environmental" for this purpose. This procedure applies only to environmental samples that contain less than reportable quantities for any foreseeable hazardous constituents according to DOT regulations promulgated in 49 CFR - Part 172.101 Appendix A.

Custody Seal - A custody seal is a narrow adhesive-backed seal that is applied to individual sample containers and/or the container (i.e., cooler) before offsite shipment. Custody seals are used to demonstrate that sample integrity has not been compromised during transportation from the field to the analytical laboratory.

Inside Container - The container, normally made of glass or plastic, that actually contacts the shipped material. Its purpose is to keep the sample from mixing with the ambient environment.

Outside Container - The container, normally made of metal or plastic, that the transporter contacts. Its purpose is to protect the inside container.

Secondary Containment - The outside container provides secondary containment if the inside container breaks (i.e., plastic overpackaging if liquid sample is collected in glass).

Excepted Quantity - Excepted quantities are limits to the mass or volume of a hazardous material in the inside and outside containers below which DOT, IATA, ICAO regulations do not apply. The excepted quantity limits are very low. Most regulated shipments will be made under limited quantity.

Limited Quantity - Limited quantity is the maximum amount of a hazardous material below which there are specific labeling or packaging exceptions.

Performance Testing - Performance testing is the required testing of outer packaging. These tests include drop and stacking tests.

Qualified Shipper - A qualified shipper is a person who has been adequately trained to perform the functions of shipping hazardous materials.

1.2.2 Associated Procedures

- CDM Federal SOP 1-2, *Sample Custody*

1.2.3 Discussion

Proper packaging and shipping is necessary to ensure the protection of the integrity of environmental samples shipped for analysis. These shipments are potentially subject to regulations published by DOT, IATA, or ICAO. Failure to abide by these rules places both CDM and the individual employee at risk of serious fines. The analytical holding times for the samples must not be exceeded. The samples shall be packed in time to be shipped for overnight delivery. Make arrangements with the laboratory before sending samples for weekend delivery.

1.3 Required Equipment

- Coolers with return address of the appropriate CDM office
- Heavy-duty plastic garbage bags
- Plastic zip-type bags, small and large
- Clear tape
- Nylon reinforced strapping tape
- Duct tape
- Vermiculite (or an equivalent nonflammable material that is inert and absorbent)*
- Bubble wrap (optional)
- Ice
- Custody seals
- Completed chain-of-custody record or contract laboratory program (CLP) custody records, if applicable
- Completed bill of lading
- "This End Up" and directional arrow labels

*Check for any client-specific or laboratory requirements related to the use of absorbent packaging materials.

1.4 Packaging Environmental Samples

The following steps must be followed when packing sample bottles and jars for shipment:

1. Verify the samples undergoing shipment meet the definition of "environmental sample" and are not a hazardous material as defined by DOT. Professional judgment and/or consultation with qualified persons such as the appropriate health and safety coordinator or the health and safety manager shall be observed.

2. Select a sturdy cooler in good repair. Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler. Line the cooler with a large heavy-duty plastic garbage bag.

3. Be sure the caps on all bottles are tight (will not leak); check to see that labels and chain-of-custody records are completed properly (SOP 1-2, Sample Custody).

4. Place all bottles in separate and appropriately sized plastic zip-top bags and close the bags. Up to three VOA vials may be packed in one bag. Binding the vials together with a rubber band on the outside of the bag, or separating them so that they do not contact each other, will reduce the risk of breakage. Bottles may be wrapped in bubble wrap. Optionally, place three to six VOA vials in a quart metal can and then fill the can with vermiculite or equivalent. ***Note***: Trip blanks must be included in coolers containing VOA samples.

5. Place 2 to 4 inches of vermiculite (or equivalent) into a cooler that has been lined with a garbage bag, and then place the bottles and cans in the bag with sufficient space to allow for the addition of packing material between the bottles and cans. It is preferable to place glass sample bottles and jars into the cooler vertically. Glass containers are less likely to break when packed vertically rather than horizontally.

6. While placing sample containers into the cooler, conduct an inventory of the contents of the shipping cooler against the chain-of-custody record. The chain-of-custody with the cooler shall reflect only those samples within the cooler.

7. Put ice in large plastic zip-top bags (double bagging the zip-tops is preferred) and properly seal. Place the ice bags on top of and/or between the samples. Several bags of ice are required (dependant on outdoor temperature, staging time, etc.) to maintain the cooler temperature at approximately 4° Celsius (C) if the analytical method requires cooling. Fill all remaining space between the bottles or cans with packing material. Securely fasten the top of the large garbage bag with fiber or duct tape.

8. Place the completed chain-of-custody record or the CLP traffic report form (if applicable) for the laboratory into a plastic zip-top bag, seal the bag, tape the bag to the inner side of the cooler lid and close the cooler.

9. The cooler lid shall be secured with nylon reinforced strapping tape by wrapping each end of the cooler a minimum of two times. Attach a completed chain-of-custody seal across the opening of the cooler on opposite sides. The custody seals shall be affixed to the cooler with half of the seal on the strapping tape so that the cooler cannot be opened without breaking the seal. Complete two more wraps around with fiber tape and place clear tape over the custody seals.

10. The shipping container lid must be marked **"THIS END UP"** and arrow labels that indicate the proper upward position of the container shall be affixed to the cooler. A label containing the name and address of the shipper (CDM) shall be placed on the outside of the container. Labels used in the shipment of hazardous materials (such as Cargo Only Air Craft, Flammable Solids, etc.) are not permitted on the outside of containers used to transport environmental samples and shall not be used. The name and address of the laboratory shall be placed on the container, or when shipping by common courier, the bill of lading shall be completed and attached to the lid of the shipping container.

2.0 Packaging and Shipping Samples Preserved with Methanol

2.1 Containers

- The maximum volume of methanol in a sample container is limited to 30 ml.
- *The sample container must not be full of methanol.*

2.2 Responsibility

It is the responsibility of the qualified shipper to:

- Ensure that the samples undergoing shipment contain no other contaminant that meets the definition of "hazardous material" as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

Note: Responsibilities may vary from site to site. Therefore, all field team member responsibilities shall be defined in the field plan or site-/project-specific quality assurance project plan (QAPP).

2.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3:

- Inner packing may consist of glass or plastic jars
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test
- Survey documentation (if shipping from Department of Energy [DOE] or radiological sites)
- Class 3 flammable liquid labels
- Orientation labels
- Consignor/consignee labels

2.4 Packaging Samples Preserved with Methanol

The following steps are to be followed when packaging limited-quantity sample shipments:

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape before sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- Wrap each container (40-ml VOA vials) in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place wrapped containers inside a polyethylene bottle filled with vermiculite; seal the bottle. (Maximum of 4 VOA vials will fit inside a 500-ml wide-mouth polyethylene bottle.)
- Total volume of methanol per shipping container must not exceed 500 ml.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

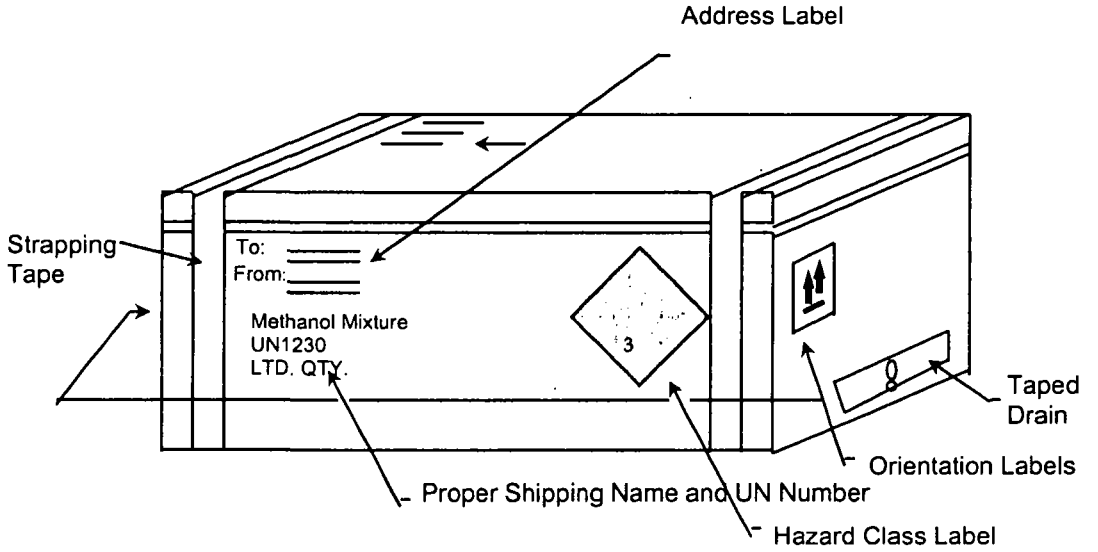
  Methanol Mixture
  UN1230
  LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Flammable Liquid label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

Note: No marking or labeling can be obscured by strapping or duct tape.
Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other nonregulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

Figure 1
Example of Cooler Label/Marking Locations



3.0 Packaging and Shipping Samples Preserved with Sodium Hydroxide

3.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Sodium Hydroxide Preservatives

Preservative		*Desired In Final Sample*		*Quantity of Preservative (ml) for Specified Container*				
		pH	Conc.	40 ml	125 ml	250 ml	500 ml	1 L
NaOH	30%	>12	0.08%		.25	0.5	1	2

5 drops = 1 ml

3.2 Responsibility

It is the responsibility of the qualified shipper to determine the amount of preservative in each sample so that accurate determination of quantities can be made.

Note: Responsibilities may vary from site to site. Therefore, all field team member responsibilities shall be defined in the field plan or site-/project-specific quality assurance project plan (QAPP).

3.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3:

- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test
- Inner packings may consist of glass or plastic jars no larger than 1 pint
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

3.4 Packaging Samples Preserved with Sodium Hydroxide

Samples containing NaOH as a preservative that exceed the excepted concentration of 0.08 percent (2 ml of a 30 percent NaOH solution per liter) may be shipped as a limited quantity per packing instruction Y819 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity samples shipments:

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape before sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- The total volume of sample in each cooler must not exceed 1 liter.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

  Sodium Hydroxide Solution
  UN1824
  LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

Note: Samples meeting the exception concentration of 0.08 percent NaOH by weight may be shipped as nonregulated or nonhazardous following the procedure in Section 1.4.

Note: No marking or labeling can be obscured by strapping or duct tape.

Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other nonregulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

4.0 Packaging and Shipping Samples Preserved with Hydrochloric Acid

4.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Hydrochloric Acid Preservatives

Preservative		*Desired in Final Sample*		*Quantity of Preservative (ml) for Specified Container*		
		pH	Conc.	40 ml	125 ml	250 ml
HCl	2N	<1.96	0.04%	.2	.5	1

5 drops = 1 ml

4.2 Responsibility

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

Note: Responsibilities may vary from site to site. Therefore, all field team member responsibilities shall be defined in the field plan or site-/project-specific quality assurance project plan (QAPP).

4.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Inner packing may consist of glass or plastic jars no larger than 1 pint.
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test.
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

4.4 Packaging Samples Preserved with Hydrochloric Acid

The following steps are to be followed when packaging limited-quantity sample shipments:

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape before sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- Wrap each container (40-ml VOA vials) in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place wrapped containers inside a polyethylene bottle filled with vermiculite; seal the bottle. (No more than 4 VOA vials will fit inside a 500-ml wide-mouth polyethylene bottle.)

- Total volume of sample inside each cooler must not exceed 1 liter.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

  Hydrochloric Acid Solution
  UN1789
  LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

Note: Samples containing less than the exception concentration of 0.04 percent HCl by weight will be shipped as nonregulated or nonhazardous following the procedure in Section 1.4.

Note: No marking or labeling can be obscured by strapping or duct tape.

Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other nonregulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

5.0 Packaging and Shipping Samples Preserved with Nitric Acid

5.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Nitric Acid Preservatives

Preservative		*Desired In Final Sample*		*Quantity of Preservative (ml) for Specified Container*				
		pH	Conc.	40 ml	125 ml	250 ml	500 ml	1 L
HNO_3	6N	<1.62	0.15%		2	4	5	8

5 drops = 1 mg/L

5.2 Responsibility

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

Note: Responsibilities may vary from site to site. Therefore, all field team member responsibilities shall be defined in the field plan or site-/project-specific quality assurance project plan (QAPP).

5.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3:

- Inner packings may consist of glass or plastic jars no larger than 100 ml.
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test.
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

5.4 Packaging Samples Preserved with Nitric Acid

Samples containing HNO_3 as a preservative that exceed the excepted concentration of 0.15 percent HNO_3 will be shipped as a limited quantity per packing instruction Y807 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity sample shipments:

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape before sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- The maximum volume of preserved solution in the cooler must not exceed 500 ml.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

Nitric Acid Solution (with less than 20 percent)
UN2031
Ltd. Qty.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

Note: Samples meeting the exception concentration of 0.15 percent HNO_3 by weight will be shipped as nonregulated or nonhazardous following the procedure in Section 1.4.

Note: No marking or labeling can be obscured by strapping or duct tape.

Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other nonregulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

6.0 Packaging and Shipping Samples Preserved with Sulfuric Acid

6.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Sulfuric Acid Preservatives

Preservative		*Desired in Final Sample*		*Quantity of Preservative (ml) for Specified Container*				
		pH	Conc.	40 ml	125 ml	250 ml	500 ml	1 L
H_2SO_4	37N	<1.15	0.35%	.1	.25	0.5	1	2

5 drops = 1 ml

6.2 Responsibility

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

Note: Responsibilities may vary from site to site. Therefore, all field team member responsibilities shall be defined in the field plan or site-/project-specific quality assurance project plan (QAPP).

6.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3:

- Inner packings may consist of glass or plastic jars no larger than 100 ml.
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test.
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

6.4 Packaging of Samples Preserved with Sulfuric Acid

Samples containing H_2SO_4 as a preservative that exceed the excepted concentration of 0.35 percent will be shipped as a limited quantity per packing instruction Y809 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity samples shipments:

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape before sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- Wrap each glass container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- The maximum volume of preserved solution in the cooler must not exceed 500 ml.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

  Sulfuric Acid Solution
  UN2796
  LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

Note: Samples containing less than the exception concentration of 0.35 percent H_2SO_4 by weight will be shipped as nonregulated or nonhazardous in accordance with the procedure described in Section 1.4.

Note: No marking or labeling can be obscured by strapping or duct tape.

Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other nonregulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

7.0 Packaging and Shipping Limited-Quantity Radioactive Samples

7.1 Containers

The inner packaging containers that may be used for these shipments include:

- Any size sample container

7.2 Description/Responsibilities

- The qualified shipper will determine that the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT.
- The qualified shipper will ship all samples that meet the Class 7 definition of radioactive materials and meet the activity requirements specified in Table 7 of 49 CFR 173.425, as Radioactive Materials in Limited Quantity. The qualified shipper will verify that all packages and their contents meet the requirements of 49 CFR 173.421, *Limited Quantities of Radioactive Materials*.
- The packaging used for shipping will meet the general requirements for packaging and packages specified in 49 CFR 173.24 and the general design requirements provided in 173.410. These standards state that a package must be capable of withstanding the effects of any acceleration, vibration, or vibration resonance that may arise under normal condition of transport without any deterioration in the effectiveness of the closing devices on the various receptacles or in the integrity of the package as a whole and without loosening or unintentionally releasing the nuts, bolts, or other securing devices even after repeated use.
- If the shipment is from a DOE facility, radiological screenings will be completed on all samples taken. The qualified shipper will review the results of each screening (alpha, beta, and gamma speciation). Samples will not be shipped offsite until the radiological screening has been performed.
- The total activity for each package will not exceed the relevant limits listed in Table 7 of 49 CFR 173.425. The A_2 value of the material will be calculated based on all radionuclides found during previous investigations (if any) in the area from which the samples are derived. The A_2 values to be used will be the most restrictive of all potential radionuclides as listed in 49 CFR 173.435.
- The radiation level at any point on the external surface of the package bearing the sample(s) will not exceed 0.005 mSv/hour (0.5 mrem/hour). These will be verified by dose and activity monitoring before shipment of the package.
- The removable radioactive surface contamination on the external surface of the package will not exceed the limits specified in 49 CFR 173.443(a). CDM will apply the DOE-established free release criteria for removable surface contamination of less than 20 dpm/100 cm^2 (alpha) and 1,000 dpm/100 cm^2 (beta/gamma). It shall be noted that these values are more conservative than the DOT requirements for removable surface contamination.
- The qualified shipper will verify that the outside of the inner packaging is marked "Radioactive."
- The qualified shipper will verify that the excepted packages prepared for shipment under the provisions of 49 CFR 173.421 have a notice enclosed, or shown on the outside of the package, that reads, **"This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910."**

Note: Responsibilities may vary from site to site. Therefore, all field team member responsibilities shall be defined in the field plan or site-/project-specific quality assurance project plan (QAPP).

7.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3:

- Survey documentation/radiation screening results (if shipping from DOE or radiological sites)
- Orientation labels
- Excepted quantities label
- Consignor/consignee labels

7.4 Packaging of Limited-Quantity Radioactive Samples

The following steps are to be followed when packaging limited-quantity sample shipments:

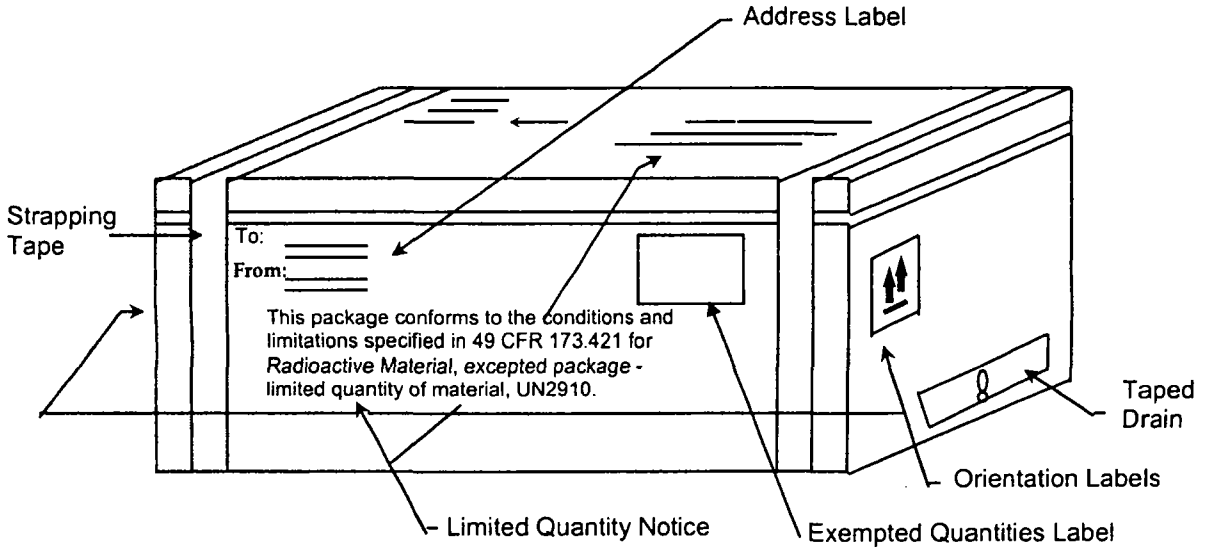
- The cooler is to be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape before sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place sufficient amount of vermiculite, or approved packaging material, in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- If required, place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- Place a label marked Radioactive on the outside of the sealed bag.
- Enclose a notice that includes the name of the consignor or consignee and the following statement: ***"This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910."***
- Note that both DOT and IATA apply different limits to the quantity in the inside packing and in the outside packing.
- The maximum weight of the package shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- If a cooler is used, wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix package orientation labels on two opposite sides of the cooler/package.
- Affix a completed Excepted Quantities label to the side of the cooler/package.
- Secure any marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of the cooler labeling/marking is shown in Figure 2.

Note: No marking or labeling can be obscured by strapping or duct tape.

- Complete the Shipment Quality Assurance Checklist (Appendix B).

Note: Except as provided in 49 CFR 173.426, the package will not contain more than 15 grams of ^{235}U.
Note: A declaration of dangerous goods is not required.

Figure 2
Radioactive Material – Limited-Quantity Cooler Marking Example



8.0 References

U. S. Environmental Protection Agency. Region IV. February 1991 or current. *Standard Operating Procedures and Quality Assurance Manual.*

_____. 1996 or current. *Sampler's Guide to the Contract Laboratory Program*, EPA/540/R-96/032.

Title 49 Code of Federal Regulations, Department of Transportation. 2005 or current revision. *Hazardous Materials Table, Special Provisions, Hazardous, Materials Communications, Emergency Response Information, and Training Requirements*, 49 CFR 172.

Title 49 Code of Federal Regulations, Department of Transportation. 2005 or current revision. *Shippers General Requirements for Shipments and Packagings*, 49 CFR 173.

Appendix A

Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity

Sample Packaging

Yes	No	N/A	
❑	❑	❑	The VOA vials are wrapped in bubble wrap and placed inside a zip-type bag.
❑	❑	❑	The VOA vials are placed into a polyethylene bottle, filled with vermiculite, and tightly sealed.
❑	❑	❑	The drain plug is taped inside and outside to ensure control of interior contents.
❑	❑	❑	The samples have been placed inside garbage bags with sufficient bags of ice to preserve samples at 4°C.
❑	❑	❑	The cooler weighs less than the 66-pound limit for limited-quantity shipment.
❑	❑	❑	The garbage bag has been sealed with tape (or tied) to prevent movement during shipment.
❑	❑	❑	The chain-of-custody has been secured to the interior of the cooler lid.
❑	❑	❑	The cooler lid and sides have been taped to ensure a seal.
❑	❑	❑	The custody seals have been placed on both the front and back hinges of the cooler, using waterproof tape.

Air Waybill Completion

Yes	No	N/A	
❑	❑	❑	Section 1 has the shipper's name, company, and address; the account number, date, internal billing reference number; and the telephone number where the shipper can be reached.
❑	❑	❑	Section 2 has the recipient's name and company along with a telephone number where they can be reached.
❑	❑	❑	Section 3 has the **Bill Sender** box checked.
❑	❑	❑	Section 4 has the **Standard Overnight** box checked.
❑	❑	❑	Section 5 has the **Deliver Weekday** box checked.
❑	❑	❑	Section 6 has the number of packages and their weights filled out. Was the total of all packages and their weights figured up and added at the bottom of Section 6?
❑	❑	❑	Under the **Transport Details** box, the **Cargo Aircraft Only** box is obliterated, leaving only the **Passenger and Cargo Aircraft** box.
❑	❑	❑	Under the **Shipment Type**, the **Radioactive** box is obliterated, leaving only the **Non-Radioactive** box.
❑	❑	❑	Under the **Nature and Quantity of Dangerous Goods** box, the **Proper Shipping Name, Class or Division, UN or ID No., Packing Group, Subsidiary Risk, Quantity and Type of Packing, Packing Instructions, and Authorization** have been filled out for the type of chemical being sent.
❑	❑	❑	The **Name, Place and Date, Signature, and Emergency Telephone Number** appears at the bottom of the FedEx Airbill.
❑	❑	❑	The statement "In accordance with IATA/ICAO" appears in the **Additional Handling Information** box.
❑	❑	❑	The **Emergency Contact Information** at the bottom of the FedEx Airbill is truly someone who can respond any time of the day or night.

Proper Shipping Name	Class or Division	UN or ID No.	Packing Group	Sub Risk	Quantity	Packing Instruction	Authorization
Hydrochloric Acid Solution	8	UN1789	II		1 plastic box × 0.5 L	Y809	Ltd. Qty.
Nitric Acid Solution (with less than 20%)	8	UN2031	II		1 plastic box × 0.5 L	Y807	Ltd. Qty.
Sodium Hydroxide Solution	8	UN1824	II		1 plastic box × 0.5 L	Y809	Ltd. Qty.
Sulfuric Acid Solution	8	UN2796	II		1 plastic box × 0.5 L	Y809	Ltd. Qty.
Methanol	3	UN1230	II		1 plastic box × 1 L	Y305	Ltd. Qty.

Sample Cooler Labeling

Yes	No	N/A	
❑	❑	❑	The proper shipping name, UN number, and Ltd. Qty. appears on the shipping container.
❑	❑	❑	The corresponding hazard labels are affixed on the shipping container; the labels are not obscured by tape.
❑	❑	❑	The name and address of the shipper and receiver appear on the top and side of the shipping container.
❑	❑	❑	The air waybill is attached to the top of the shipping container.
❑	❑	❑	**Up Arrows** have been attached to opposite sides of the shipping container.
❑	❑	❑	Packaging tape does not obscure markings or labeling.

Appendix B
Shipment Quality Assurance Checklist

Date: _____ Shipper: _____ Destination: _____

Item(s) Description: _____

Radionuclide(s): _____

Radiological Survey Results: surface _____mrem/hr 1 meter _____

Instrument Used: Mfgr: _____ Model: _____

S/N: _____ Cal Date: _____

Limited-Quantity or Instrument and Article

Yes	No		
___	___	1.	Strong tight package (package that will not leak material during conditions normally incidental to transportation).
___	___	2.	Radiation levels at any point on the external surface of package less than or equal to 0.5 mrem/hr.
___	___	3.	Removable surface contamination less than 20 dpm/100 cm^2 (alpha) and 1,000 dpm/100 cm^2 (beta/gamma).
___	___	4.	Outside inner package bears the marking "Radioactive."
___	___	5.	Package contains less than 15 grams of ^{235}U (check yes if ^{235}U not present).
___	___	6.	Notice enclosed in or on the package that includes the consignor or consignee and the statement, **"This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910."**
___	___	7.	Activity less than that specified in 49 CFR 173.425. Permissible package limit: Package Quantity:
___	___	8.	On all air shipments, the statement **Radioactive Material, excepted package-limited quantity of material** shall be noted on the air waybill.

Qualified Shipper: _____ Signature: _____

Project Specific Modification

SOP No.: 2-2

SOP Title: Guide to Handling Investigation-Derived Waste

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/7/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Site-specific procedures for disposing of Libby amphibole asbestos contaminated IDW are different than CDM Technical SOP 2-2. These modifications are necessary for the entire duration of the project.

All IDW will be handled in accordance with CDM Technical SOP 2-2, Guide to Handling Investigation-Derived Waste, with the following modifications:

Section 5.2, Off Site Disposal - All IDW (not including excess soil volume) will be collected in transparent garbage bags and marked "IDW" with an indelible marker. These bags will be deposited into the asbestos contaminated waste stream for deposal at the mine.

Guide to Handling Investigation-Derived Waste

SOP 2-2
Revision: 5
Date: March 2007

Prepared: Tim Eggert

Technical Review: Matt Brookshire

E-Signed by Michael C. Malloy
VERIFY authenticity with ApproveIt

QA Review: Jo Nell Mullins

E-Signed by P. Michael Schwan
VERIFY authenticity with ApproveIt

Approved:

Signature/Date

Issued:

Signature/Date

1.0 Objective

This standard operating procedure (SOP) presents guidance for the management of investigation-derived waste (IDW). The primary objectives for managing IDW during field activities include:

- Leaving the site in no worse condition than existed before field activities
- Removing wastes that pose an immediate threat to human health or the environment
- Proper handling of onsite wastes that do not require offsite disposal or extended aboveground containerization
- Complying with federal, state, local, and facility applicable or relevant and appropriate requirements (ARARs)
- Careful planning and coordination of IDW management options
- Minimizing the quantity of IDW

2.0 Background

2.1 Definitions

Hazardous Waste - Discarded material that is regulated listed waste, or waste that exhibits ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.3 or state regulations.

Investigation-Derived Wastes - Discarded materials resulting from field activities such as sampling, surveying, drilling, excavations, and decontamination processes that, in present form, possess no inherent value or additional usefulness without treatment. Wastes may be solid, sludge, liquid, gaseous, or multiphase materials that may be classified as hazardous or nonhazardous.

Mixed Waste - Any material that has been classified as hazardous and radioactive.

Radioactive Wastes - Discarded materials that are contaminated with radioactive constituents with specific activities in concentrations greater than the latest regulatory criteria (i.e., 10 CFR 20).

Treatment, Storage, and Disposal Facility (TSDF) - Permitted facilities that accept hazardous waste shipments for further treatment, storage, and/or disposal. These facilities must be permitted by the U. S. Environmental Protection Agency (EPA) and appropriate state and local agencies.

2.2 Discussion

Field investigation activities result in the generation of waste materials that may be characterized as hazardous or radioactive waste. IDWs may include drilling muds, cuttings, and purge water from test pit and well installation; purge water, soil, and other materials from collection of samples; residues from testing of treatment technologies and pump and treat systems; personal protective equipment (PPE); solutions (aqueous or otherwise) used to decontaminate nondisposable protective clothing and equipment; and other wastes or supplies used in sampling and testing potentially hazardous or radiologically contaminated material.

Note: The client's representatives may not be aware of all potential contaminants. The management of IDW must comply with applicable regulatory requirements.

3.0 General Responsibilities

Site Manager - The site manager is responsible for ensuring that all IDW procedures are conducted in accordance with this SOP. The site manager is also responsible for ensuring that handling of IDW is in accordance with site-specific requirements.

Project Manager - The project manager is responsible for identifying site-specific requirements for the disposal of IDW in accordance with federal, state, and/or facility requirements.

Field Crew Members - Field crew members are responsible for implementing this SOP and communicating any unusual or unplanned condition to the project manager's attention.

***Note**: Responsibilities may vary from site to site. Therefore, all field team member responsibilities shall be defined in the* field plan or site/project specific quality assurance plan.

4.0 Required Equipment

Equipment required for IDW containment will vary according to site-specific/client requirements. Management decisions concerning the necessary equipment required shall consider: containment method, sampling, labeling, maneuvering, and storage (if applicable). Equipment must be onsite and inspected before commencing work.

4.1 IDW Containment Devices

The appropriate containment device (drums, tanks, etc.) will depend on site- or client-specific requirements and the ultimate disposition of the IDW. Typical IDW containment devices can include:

- Plastic sheeting (polyethylene) with a minimum thickness of 20 millimeters
- Department of Transportation (DOT)-approved steel containers
- Polyethylene or steel bulk storage tanks

Containment of IDW shall be segregated by waste type (i.e., solid or liquid, corrosive or flammable, etc.) and source location. Volume of the appropriate containment device shall be site-specific.

4.2 IDW Container Labeling

A "Waste Container" or "IDW Container" label or indelible marking shall be applied to each container. Labeling or marking requirements for onsite IDW not expected to be transported offsite are:

- Labels and markings that contain the following information: project name, generation date, location of waste origin, container identification number, sample number (if applicable), and contents (drill cuttings, purge water, PPE, etc.).
- Each label or marking will be applied to the upper one-third of the container at least twice, on opposite sides.
- Containers that are 5 gallons or less may only require one label or set of markings.
- Labels or markings will be positioned on a smooth part of the container. The label must not be affixed across container bungs, seams, ridges, or dents.
- Labels must be constructed of a weather-resistive material with markings made with a permanent marker or paint pen and capable of enduring the expected weather conditions. If markings are used, the color must be easily distinguishable from the drum color.
- Labels will be secured in a manner to ensure the label remains affixed to the container.

Labeling or marking requirements for IDW expected to be transported offsite must be in accordance with the requirements of 49 CFR 172.

4.3 IDW Container Movement

Staging areas for IDW containers shall be predetermined and in accordance with site-specific and/or client requirements. Arrangements shall be made before field mobilization as to the methods and personnel required to safely transport IDW containers to the staging area. Transportation offsite onto a public roadway is prohibited unless 49 CFR 172 requirements are met.

4.4 IDW Container Storage

Containerized IDW shall be staged pending chemical analysis or further onsite treatment. Staging areas and bulk storage procedures are to be determined according to site-specific requirements. Containers are to be stored in such a fashion that the labels can be easily read. A secondary/spill container must be provided for liquid IDW storage and as appropriate for solid IDW storage.

5.0 Procedures

The three general options for managing IDW are (1) collection and onsite disposal, (2) collection for offsite disposal, and (3) collection and interim management. Attachment 1 summarizes media-specific information on generation processes and management options. The option selected shall take into account the following factors:

- Type (soil, sludge, liquid, debris), quantity, and source of IDW
- Risk posed by managing the IDW onsite
- Compliance with regulatory requirements
- IDW minimization and consistency with the IDW remedy and the site remedy

In all cases the client shall approve the plans for IDW. Formal plans for the management of IDW must be prepared as part of a work plan or separate document.

5.1 Collection and Onsite Disposal

5.1.1 Soil/Sludge/Sediment

The options for handling soil/sludge/sediment IDW are as follows:

1. Return to boring, pit, or source immediately after generation as long as returning the media to these areas will not increase site risks (e.g., the contaminated soil will not be replaced at a greater depth than where it was originally so that it will not contaminate "clean" areas).

2. Spread around boring, pit, or source within the area of contamination (AOC) as long as returning the media to these areas will not increase site risks (e.g., direct contact with surficial contamination).

3. Consolidate in a pit within the AOC as long as returning the media to these areas will not increase site risks (e.g., the contaminated soil will not be replaced at a greater depth than where it was originally so that it will not contaminate "clean" areas).

4. Send to onsite TSDF - may require analytical analysis before treatment/disposal.

Note: These options may require client and/or regulatory approval.

5.1.2 Aqueous Liquids

The options for handling aqueous liquid IDW are as follows:

1. Discharge to surface water, only when IDW is not contaminated.

2. Discharge to ground surface close to the well, only if soil contaminants will not be mobilized in the process and the action will not contaminate clean areas. If IDW from the sampling of background upgradient wells is not a community concern or associated with soil contamination, this presumably uncontaminated IDW may be released on the ground around the well.

3. Discharge to sanitary sewer, only when IDW is not contaminated.

4. Send to onsite TSDF - may require analysis before treatment/disposal.

Note: These options may require analytical results to obtain client and/or regulatory approval.

5.1.3 Disposable PPE

The options for handling disposable PPE are as follows:

1. Double-bag contents in nontransparent trash bags and place in onsite industrial dumpster, only if PPE is not contaminated.

2. Containerize, label, and send to onsite TSDF - may require analysis before treatment/disposal.

5.2 Collection for Offsite Disposal

Before sending to an offsite TSDF, analysis may be required. Manifests are required. In some instances, a bill of lading can be used for nonhazardous solid IDW (i.e., wooden pallets, large quantities of plastic sheeting). Arrangements must be made with the client responsible for the site to sign as generator on any waste profile and all manifests or bill of ladings; it is CDM's policy not to sign manifests. The TSDF and transporter must be permitted for the respective wastes. Nonbulk containers (e.g., drums) must have a DOT-approved label adhered to the container and all required associated placard stickers before leaving for a TSDF off site. These labels must include information as required in 49 CFR 172. Bulk containers (i.e., rolloffs, tanks) do not require container specific labels for transporting off site, but must include appropriate placards as required in 49 CFR 172.

5.2.1 Soil/Sludge/Sediment

When the final site remedy requires offsite treatment and disposal, the IDW may be stored (e.g., drummed, covered in a waste pile) or returned to its source until final disposal. The management option selected shall take into account the potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.2.2 Aqueous Liquids

When the final site remedy requires offsite treatment and disposal, the IDW may be stored (e.g., mobile tanks or drums with appropriate secondary containment) until final disposal. The management option selected shall take into account the potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.2.3 Disposable PPE

When the final site remedy requires offsite treatment disposal, the IDW may be containerized and stored. The management option selected shall take into account potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.3 Collection and Interim Management

All interim measures must be approved by the client and regulatory agencies.

1. Storing IDW onsite until the final action may be practical in the following situations:
   - Returning wastes (especially sludges and soils) to their onsite source area would require reexcavation for disposal in the final remediation alternative.
   - Interim storage in containers may be necessary to provide adequate protection to human health and the environment.
   - Offsite disposal options may trigger land disposal regulations under the Resource Conservation and Recovery Act (RCRA). Storing IDW until the final disposal of all wastes from the site will eliminate the need to address this issue more than once.
   - Interim storage may be necessary to provide time for sampling and analysis.

2. Segregate and containerize all waste for future treatment and/or disposal.
   - Containment options for soil/sludge/sediment may include drums or covered waste piles in AOC.
   - Containment options for aqueous liquids may include mobile tanks or drums.
   - Containment options for PPE may include drums or roll-off boxes.

6.0 Restrictions/Limitations

Site Managers Shall Determine the Most Appropriate Disposal Option for Aqueous Liquids on a Site-Specific Basis. Parameters to consider, especially when determining the level of protection, include the volume of IDW, the contaminants present in the groundwater, the presence of contaminants in the soil at the site, whether the groundwater or surface water is a drinking water supply, and whether the groundwater plume is contained or moving. Special disposal/handling may be needed for drilling fluids because they may contain significant solid components.

Disposable sampling materials, disposable PPE, decontamination fluids, etc. will always be managed on a site-specific basis. **Under No Circumstances Shall These Types of Materials Be Brought Back to the Office or Warehouse.**

7.0 References

Environmental Resource Center. 1997. *Hazardous Waste Management Compliance Handbook 2nd Edition*. Karnofsky (Editor).

Academy of Certified Hazardous Materials Manager. May 1999. *Hazardous Materials Management Desk Reference*. Cox.

Title 49 Code of Federal Regulations, Department of Transportation. 2005 or current revision. *Hazardous Materials Table, Special Provisions, Hazardous, Materials Communications, Emergency Response Information, and Training Requirements*, 49 CFR 172.

U. S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001.1.

_____. August 1990. *Low-Level Mixed Waste: A RCRA Perspective for NRC Licensees*, EPA/530-SW-90-057.

_____. May 1991. *Management of Investigation-Derived Wastes During Site Inspections*, EPA/540/G-91/009.

_____. January 1992. *Guide to Management of Investigation-Derived Wastes*, 9345.3-03FS.

_____. Region IV. November 2001. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual.*

Attachment 1
IDW Management Options

Type of IDW	*Generation Processes*	*Management Options*
Soil	▪ Well/Test pit installations ▪ Borehole drilling ▪ Soil sampling	**Onsite Disposal** ▪ Return to boring, pit, or source immediately after generation ▪ Spread around boring, pit, or source within the AOC ▪ Consolidate in a pit (within the AOC) ▪ Send to onsite TSDF **Offsite Disposal** ▪ Client to send to offsite TSDF **Interim Management** ▪ Store for future treatment and/or disposal
Sludge/Sediment	▪ Sludge pit/sediment sampling	**Onsite Disposal** ▪ Return to boring, pit, or source immediately after generation ▪ Send to onsite TSDF **Offsite Disposal** ▪ Client to send to offsite TSDF **Interim Management** ▪ Store for future treatment and/or disposal
Aqueous Liquids (groundwater, surface water, drilling fluids, wastewaters)	▪ Well installation/development ▪ Well purging during sampling ▪ Groundwater discharge during pump tests ▪ Surface water sampling ▪ Wastewater sampling	**Onsite Disposal** ▪ Pour onto ground close to well (nonhazardous waste) ▪ Discharge to sewer ▪ Send to onsite TSDF **Offsite Disposal** ▪ Client to send to offsite commercial treatment unit ▪ Client to send to publicly owned treatment works (POTW) **Interim Management** ▪ Store for future treatment and/or disposal
Decontamination Fluids	▪ Decontamination of PPE and equipment	**Onsite Disposal** ▪ Send to onsite TSDF ▪ Evaporate (for small amounts of low contamination organic fluids) ▪ Discharge to ground surface **Offsite Disposal** ▪ Client to send to offsite TSDF ▪ Discharge to sewer **Interim Management** ▪ Store for future treatment and/or disposal
Disposable PPE and Sampling Equipment	▪ Sampling procedures or other onsite activities	**Onsite Disposal** ▪ Place in onsite industrial dumpster ▪ Send to onsite TSDF **Offsite Disposal** ▪ Client to send to offsite TSDF **Interim Management** ▪ Store for future treatment and/or disposal

Adapted from U. S. Environmental Protection Agency, *Guide to Management of Investigation-Derived Wastes*, 9345-03FS, January 1992.

CDM Standard Operating Procedure

Project-Specific Modification

SOP No.: 4-1

SOP Title: Field Logbook Content and Control

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/7/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Site-specific procedures field logbook completions are different than CDM Technical SOP 4-1. These modifications are necessary for the entire duration of the project.

All content and control of will logbooks will be done accordance with CDM Technical SOP 4-1, Field Logbook Content and Control, with the following modifications:

Section 5.2, Operation – A new page will be completed for each property where information is collected for RI activities. The header information will include the address, the name of the property owner, and the building identification number of structures on the property.

When following the line-out and signature procedures to close a logbook page, the author must also print their name under the signature.

Field Logbook Content and Control

SOP 4-1
Revision: 6
Date: March 2007

Prepared: Del Baird

Technical Review: Laura Splichal

E-Signed by Michael C. Malloy
VERIFY authenticity with ApproveIt

QA Review: Jo Nell Mullins

E-Signed by P. Michael Schwan
VERIFY authenticity with ApproveIt

Approved:

Signature/Date

Issued:

Signature/Date

1.0 Objective

The objective of this standard operating procedure (SOP) is to set CDM Federal (CDM) criteria for content entry and form of field logbooks. Field logbooks are an essential tool to document field activities for historical and legal purposes.

2.0 Background

2.1 Definitions

Biota - The flora and fauna of a region.

Magnetic Declination Corrections - Compass adjustments to correct for the angle between magnetic north and geographical meridians.

2.2 Discussion

Information recorded in field logbooks includes field team names; observations; data; calculations; date/time; weather; and description of the data collection activity, methods, instruments, and results. Additionally, the logbook may contain deviations from plans and descriptions of wastes, biota, geologic material, and site features including sketches, maps, or drawings as appropriate.

3.0 General Responsibilities

Field Team Leader (FTL) - The FTL is responsible for ensuring that the format and content of data entries are in accordance with this procedure.

Site Personnel - All CDM employees who make entries in field logbooks during onsite activities are required to read this procedure before engaging in this activity. The FTL will assign field logbooks to site personnel who will be responsible for their care and maintenance. Site personnel will return field logbooks to the records file at the end of the assignment.

Note: Responsibilities may vary from site to site. Therefore, all field team member responsibilities should be defined in the field plan or site-/project-specific quality assurance plan.

4.0 Required Equipment

- Site-specific plans
- Field logbook
- Indelible black or blue ink pen
- Ruler or similar scale

5.0 Procedures

5.1 Preparation

In addition to this SOP, site personnel responsible for maintaining logbooks must be familiar with all procedures applicable to the field activity being performed. These procedures should be consulted as necessary to obtain specific information about equipment and supplies, health and safety, sample collection, packaging, decontamination, and documentation. These procedures should be located at the field office or vehicle for easy reference.

Field logbooks shall be bound with lined, consecutively numbered pages. All pages must be numbered before initial use of the logbook. Before use in the field, each logbook will be marked with a specific document control number issued by

the document control administrator, if required by the contract quality implementation plan (QIP). Not all contracts require document control numbers. The following information shall be recorded on the cover of the logbook:

- Field logbook document control number (if applicable).
- Activity (if the logbook is to be activity-specific), site name, and location.
- Name of CDM contact and phone number(s) (typically the project manager).
- Start date of entries.
- End date of entries.
- In specific cases, special logbooks may be required (e.g., waterproof paper for stormwater monitoring).

The first few (approximately five) pages of the logbook will be reserved for a table of contents (TOC). Mark the first page with the heading and enter the following:

Table of Contents

Date/Description	Pages
(Start Date)/Reserved for TOC	1-5

The remaining pages of the table of contents will be designated as such with "TOC" written on the top center of each page. The table of contents should be completed as activities are completed and before placing the logbook in the records file.

5.2 Operation

Requirements that must be followed when using a logbook:

- Record work, observations, quantities of materials, calculations, drawings, and related information directly in the logbook. If data collection forms are specified by an activity-specific plan, this information does not need to be duplicated in the logbook. However, any forms used to record site information must be referenced in the logbook.
- Do not start a new page until the previous one is full or has been marked with a single diagonal line so that additional entries cannot be made. Use both sides of each page.
- Do not erase or blot out any entry at any time. Indicate any deletion by a single line through the material to be deleted. Initial and date each deletion. Take care to not obliterate what was written previously.
- Do not remove any pages from the book.

Specific requirements for field logbook entries include:

- Initial and date each page.
- Sign and date the final page of entries for each day.
- Initial and date all changes.
- *Multiple authors must sign out the logbook by inserting the following:*
  Above notes authored by:
  - (Sign name)
  - (Print name)
  - (Date)
- A new author must sign and print his/her name before additional entries are made.
- Draw a diagonal line through the remainder of the final page at the end of the day.
- Record the following information on a daily basis:
  - Date and time
  - Name of individual making entry
  - Names of field team and other persons onsite
  - Description of activity being conducted including station or location (i.e., well, boring, sampling location number) if appropriate
  - Weather conditions (i.e., temperature, cloud cover, precipitation, wind direction, and speed) and other pertinent data
  - Level of personal protection used
  - Serial numbers of instruments
  - Equipment calibration information
  - *Serial/tracking numbers on documentation (e.g., carrier air bills)*

Entries into the field logbook shall be preceded with the time (written in military units) of the observation. The time should be recorded frequently and at the point of events or measurements that are critical to the activity being logged. All measurements made and samples collected must be recorded unless they are documented by automatic methods (e.g., data logger) or on a separate form required by an operating procedure. In these cases, the logbook must reference the automatic data record or form.

At each station where a sample is collected or an observation or measurement made, a detailed description of the location of the station is required. Use a compass (include a reference to magnetic declination corrections), scale, or nearby survey markers, as appropriate. A sketch of station location may be warranted. All maps or sketches made in the logbook should have descriptions of the features shown and a direction indicator. It is preferred that maps and sketches be oriented so that north is toward the top of the page. Maps, sketches, figures, or data that will not fit on a logbook page should be referenced and attached to the logbook to prevent separation.

Other events and observations that should be recorded include:

- Changes in weather that impact field activities.
- Deviations from procedures outlined in any governing documents. Also record the reason for any noted deviation.
- Problems, downtime, or delays.
- Upgrade or downgrade of personal protection equipment.
- Visitors to the site.

5.3 Post-Operation

To guard against loss of data as a result of damage or disappearance of logbooks, completed pages shall be periodically photocopied (weekly, at a minimum) and forwarded to the field or project office. Other field records shall be photocopied and submitted regularly and as promptly as possible to the office. When possible, electronic media such as disks and tapes should be copied and forwarded to the project office.

At the conclusion of each activity or phase of site work, the individual responsible for the logbook will ensure that all entries have been appropriately signed and dated and that corrections were made properly (single lines drawn through incorrect information, then initialed and dated). The completed logbook shall be submitted to the records file.

6.0 Restrictions/Limitations

Field logbooks constitute the official record of onsite technical work, investigations, and data collection activities. Their use, control, and ownership are restricted to activities pertaining to specific field operations carried out by CDM personnel and their subcontractors. They are documents that may be used in court to indicate dates, personnel, procedures, and techniques employed during site activities. Entries made in these logbooks should be factual, clear, precise, and nonsubjective. Field logbooks, and entries within, are not to be used for personal use.

7.0 References

Sandia National Laboratories. 1991. *Procedure for Preparing Sampling and Analysis Plan, Site-Specific Sampling Plan, and Field Operating Procedures*, QA-02-03. Albuquerque Environmental Program, Department 3220, Albuquerque, New Mexico.

Sandia National Laboratories. 1992. *Field Operation Procedure for Field Logbook Content and Control.* Environmental Restoration Department, Division 7723, Albuquerque, New Mexico.

CDM Standard Operating Procedure

Project-Specific Modification

SOP No.: 4-2

SOP Title: Photographic Documentation of Field Activities

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/7/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Site-specific procedures for photographs taken by digital cameras are different than the current SOP.

All photographs will be recorded in accordance with CDM Technical SOP 4-2, Photographic Documentation of Field Activities, with the following modifications:

Section 5.2.2, General Guidelines for Still Photography - A slate is not required for each new roll of film. The information for the slate will be recorded in the field logbook. The numbers assigned by the digital camera will be used instead of the photographer assigning the number. The caption information will either be on the back of the photograph or the photograph will be numbered or labeled and the caption information listed next to the number or label in the photograph log. On the digital photos, a caption will be included in the picture stating property address/location, date, and name of feature. All team members, as stated in the logbook, will be photographers and witnesses at the property. Slates are not required for close-up photographs. Instead the required information can be listed in the logbook or photograph log. A color strip is not required for close-up or feature photographs.

Section 5.2.4, Photographic Documentation - The name of the laboratory, time and date of drop-off, and receipt of film is not required to be recorded for this project.

Project-Specific Modification

Section 5.3.2, Archive Procedures - Digital photographs will be archived on compact discs. These discs will be assigned a document control dumber written on the disc case as well as well as the disc.

Photographic Documentation of Field Activities

SOP 4-2
Revision: 7
Date: March 2007

Prepared: David O. Johnson

Technical Review: Sharon Budney

E-Signed by Michael C. Malloy
VERIFY authenticity with ApproveIt

QA Review: Jo Nell Mullins

E-Signed by P. Michael Schwan
VERIFY authenticity with ApproveIt

Approved:

Signature/Date

Issued:

Signature/Date

1.0 Objective

The purpose of this standard operating procedure (SOP) is to provide standard guidelines and methods for photographic documentation, which include still and digital photography and videotape or DVD recordings of field activities and site features (geologic formations, core sections, lithologic samples, water samples, general site layout, etc.). This document shall provide guidelines designed for use by a professional or amateur photographer. This SOP is intended for circumstances when formal photographic documentation is required. Based on project requirements, it may not be applicable for all photographic activities.

2.0 Background

2.1 Definitions

Photographer - A photographer is the camera operator (professional or amateur) of still photography, including digital photography, or videotape or digital versatile discs (DVD) recording whose primary function with regard to this SOP is to produce documentary or data-oriented visual media.

Identifier Component - Identifier components are visual components used within a photograph such as visual slates, reference markers, and pointers.

Standard Reference Marker - A standard reference marker is a reference marker that is used to indicate a feature size in the photograph and is a standard length of measure, such as a ruler, meter stick, etc. In limited instances, if a ruled marker is not available or its use is not feasible, it can be a common object of known size placed within the visual field and used for scale.

Slates - Slates are blank white index cards or paper used to present information pertaining to the subject/procedure being photographed. Letters and numbers on the slate will be bold and written with black indelible marking pens.

Arrows and Pointers - Arrows and pointers are markers/pointers used to indicate and/or draw attention to a special feature within the photograph.

Contrasting Backgrounds - *Contrasting backgrounds are backdrops used to lay soil samples, cores, or other objects on* for clearer viewing and to delineate features.

Data Recording Camera Back - A data recording camera back is a camera attachment or built-in feature that will *record, at the very least, frame numbers and dates directly on the film.*

2.2 Associated Procedures

- CDM Federal SOP 4-1, *Field Logbook Content and Control*

2.3 Discussion

Photographs and videotape or DVD recordings made during field investigations are used as an aid in documenting and describing site features, sample collection activities, equipment used, and possible lithologic interpretation. This SOP is *designed to illustrate the format and desired placement of identifier components, such as visual slates, standard*

reference markers, and pointers. These items shall become an integral part of the "visual media" that, for the purpose of this document, shall encompass still photographs, digital photographs, videotape recordings (or video footage), and recordings on DVDs. The use of a photographic logbook and standardized entry procedures are also outlined. These procedures and guidelines will minimize potential ambiguities that may arise when viewing the visual media and ensure the representative nature of the photographic documentation.

3.0 General Responsibilities

Field Team Leader - The field team leader (FTL) is responsible for ensuring that the format and content of photographic documentation are in accordance with this procedure. The FTL is responsible for directing the photographer to specific situations, site features, or operations that the photographer will be responsible for documenting.

Photographer - The photographer shall seek direction from the FTL and regularly discuss the visual documentation requirements and schedule. The photographer is responsible for maintaining a logbook per Sections 5.1, 5.2.4, and 5.3.1 of this SOP. Responsibilities will be defined in the project sampling plan.

Note: Responsibilities may vary from site to site. Therefore, all field team member responsibilities shall be defined in the field plan or site/quality assurance project plan (QAPP).

4.0 Required Equipment

A general list of equipment that may be used:

- 35mm camera or disposable single use camera (35mm or panoramic use)
- Digital camera
- Extra batteries for 35mm camera
- Video camera and appropriate storage media (e.g., video tapes, DVDs)
- Logbook
- Indelible black or blue ink pen
- Standard reference markers
- Slates
- Arrows or pointers
- Contrasting backgrounds
- Medium speed, or multi purpose fine-grain, color, 35mm negative film or slide film (project dependent)
- Data recording camera back (if available)
- Storage medium for digital camera

5.0 Procedures

5.1 Documentation

A commercially available, bound logbook will be used to log and document photographic activities. Review CDM Federal SOP 4-1, *Field Logbook Content and Control* and prepare all supplies needed for logbook entries.

Note: A separate photographic logbook is not required. A portion of the field logbook may be designated as the photographic log and documentation section.

Field Health and Safety Considerations

There are no hazards that an individual will be exposed to specific to photographic documentation. However, site-specific hazards may arise depending on location or operation. Personal protective equipment used in this operation will be site-specific and dictated through requirements set by the site safety officer, site health and safety plan, and/or prescribed by the CDM Federal Corporate Health and Safety Program. The photographer should contact the site safety officer for health and safety orientation before commencing field activities. The site health and safety plan must be read before entry to the site, and all individuals must sign the appropriate acknowledgement that this has been done.

The photographer should be aware of any potential physical hazards while photographing the subject (e.g., traffic, low overhead hazard, edge of excavation).

5.2 Operation

5.2.1 General Photographic Activities in the Field

The following sections provide general guidelines that should be followed to visually document field activities and site features using still/digital cameras and video equipment. Listed below are general suggestions that the photographer should consider when performing activities under this SOP:

- The photographer should be prepared to make a variety of shots, from close-up to wide-angle. Many shots will be repetitive in nature or format, especially close-up site feature photographs. Consideration should therefore be given to designing a system or technique that will provide a reliable repetition of performance.
- All still film photographs should be made using a medium speed, or multi purpose fine-grain, color negative film in the 35mm format unless otherwise directed by the FTL.
- It is suggested that Kodak brand "Ektapress Gold Deluxe" film or equivalent be used as the standard film for the still photography requirements of the field activities. This film is stable at room temperature after exposure and will better survive the time lag between exposure and processing. It is suggested that film speed ASA 100 should be used for outdoor photographs in bright sunlight, ASA 200 film should be used in cloudy conditions, and ASA 400 film should be used indoors or for very low-light outdoor photographs.
- No preference of videotape or DVD brand along with digital storage medium is specified and is left to the discretion of the photographer.
- The lighting for sample and feature photography should be oriented toward a flat condition with little or no shadow. If the ambient lighting conditions are inadequate, the photographer should be prepared to augment the light (perhaps with reflectors or electronic flash) to maintain the desired visual effect.
- Digital cameras have multiple photographic quality settings. A camera that obtains a higher resolution (quality) has a higher number of pixels and will store a fewer number of photographs per digital storage medium.

5.2.2 General Guidelines for Still Photography

Slate Information

It is recommended that each new roll of film or digital storage medium shall contain on the first usable frame (for film) a slate with consecutively assigned control numbers (a consecutive, unique number that is assigned by the photographer as in sample numbers).

Caption Information

All still photographs will have a full caption permanently attached to the back or permanently attached to a photo log sheet. The caption should contain the following information (digital photographs should have a caption added after the photographs are downloaded):

- Film roll control number (if required) and photograph sequence number
- Date and time
- Photographer
- Description of activity/item shown (e.g., name of facility/site, specific project name, project number)
- Direction (if applicable)

When directed by the sampling plan, a standard reference marker should be used in all documentary visual media. While the standard reference marker will be predominantly used in close-up feature documentation, inclusion in all scenes should be considered.

Digital media should be downloaded at least once each day to a personal computer; the files should be in either "JPEG" or "TIFF" format. Files should be renamed at the time of download to correspond to the logbook. It is recommended the electronic files be copied to a compact disc for backup.

Close-Up and Feature Photography

When directed by the sampling plan, close-up photographs should include a standard reference marker of appropriate size as an indication of the feature size and contain a slate marked with the site name and any identifying label, such as a well number or core depth, that clearly communicates to the viewer the specific feature being photographed.

Feature samples, core pieces, and other lithologic media should be photographed as soon as possible after they have been removed from their in situ locations. This enables a more accurate record of their initial condition and color. When directed by the sampling plan, include a standard reference color strip (color chart such as Munsell Soil Color Chart or that available from Eastman Kodak Co.) within the scene. This is to be included for the benefit of the viewer of the photographic document and serves as a reference aid to the viewer for formal lithologic observations and interpretations.

Site Photography
Site photography, in general, will consist predominantly of medium- and wide-angle shots. A standard reference marker should be placed adjacent to the feature or, when this is not possible, within the same focal plane.

While it is encouraged that a standard reference marker and caption/slate be included in the scene, it is understood that situations will arise that preclude their inclusion within the scene. This will be especially true of wide-angle shots. In such a case, the film/tape control number shall be entered in the photographic logbook along with the frame number and all other information pertinent to the scene.

Panoramic
In situations where a wide-angle lens does not provide sufficient subject detail, a single-use disposable panoramic camera is recommended. If this type of camera is not available, a panoramic series of two or three photos would be appropriate. Panoramas can provide greater detail while covering a wide subject, such as an overall shot of a site.

To shoot a panoramic series using a standard 35mm or digital camera, the following procedures are recommended:

- Use a stable surface or tripod to support the camera
- Allow a 20- to 30-percent overlap while maintaining a uniform horizon
- Complete two to three photos per series

5.2.3 General Photographic Documentation Using Video Cameras
As a reminder, it is not within the scope of this document to set appropriate guidelines for presentation or "show" videotape or DVD recording. The following guidelines are set for documentary videotape or DVD recordings only and should be implemented at the discretion of the site personnel.

Documentary videotape or DVD recordings of field activities may include an audio slate for all scenes. At the beginning of each video session, an announcer will recite the following information: date, time (in military units), photographer, site ID number, and site location. This oral account may include any additional information clarifying the subject matter being recorded.

A standard reference marker may be used when taking close-up shots of site features with a video camera. The scene may also include a caption/slate. It should be placed adjacent and parallel to the feature being photographed.

It is recommended that a standard reference marker and caption/slate be included in all scenes. The caption information is vital to the value of the documentary visual media and should be included. If it is not included within the scene, it should be placed before the scene.

Original video recordings will not be edited. This will maintain the integrity of the information contained on the videotape or DVD. If editing is desired, a working copy of the original video recording can be made.

A label should be placed on the videotape or DVD with the appropriate identifying information (project name, project number, date, location, etc.).

5.2.4 Photographic Documentation
Photographic activities must be documented in a photographic logbook or in a section of the field logbook. The photographer will be responsible for making proper entries.

In addition to following the technical standards for logbook entry as referenced in CDM Federal SOP 4-1, the following information should be maintained in the appropriate logbook:

- Photographer name.
- If required, an entry shall be made for each new roll/tape/DVD control number assigned.
- Sequential tracking number for each photograph taken (for digital cameras, the camera-generated number may be used).
- Date and time (military time).
- Location.
- A description of the activity/item photographed.
- If needed, a description of the general setup, including approximate distance between the camera and the subject, may be recorded in the logbook.
- Record as much other information as possible to assist in the identification of the photographic document.

5.3 Post Operation

All film will be sent for development and printing to a photographic laboratory (to be determined by the photographer). The photographer will be responsible for arranging transport of the film from the field to the photographic laboratory. The photographer shall also be responsible for arranging delivery of the negatives and photographs, digital storage medium, or videotape or DVD to the project management representative to be placed in the project files.

5.3.1 Documentation

At the end of each day's photographic session, the photographer(s) will ensure that the appropriate logbook has been completely filled out and maintained as outlined in CDM Federal SOP 4-1.

5.3.2 Archive Procedures

- Photographs and the associated set of uncut negatives, digital media, and original unedited documentary video recordings will be submitted to the project files and handled according to contract records requirements. The project manager will ensure their proper distribution.
- Completed pages of the appropriate logbook will be copied weekly and submitted to the project files.

6.0 Restrictions/Limitations

This document is designed to provide a set of guidelines for the field amateur or professional photographer to ensure that an effective and standardized program of visual documentation is maintained.

It is not within the scope of this document to provide instruction in photographic procedures, nor is it within the scope of this document to set guidelines for presentation or "show" photography.

The procedures outlined herein are general by nature. The photographer is responsible for specific operational activity or procedure. Questions concerning specific procedures or requirements should be directed to the project manager or FTL.

Note: Some sites do not permit photographic documentation. Check with the site contact for any restrictions.

7.0 References

U. S. Army Corps of Engineers. 2001. *Requirements for the Preparation of Sampling and Analysis Plans*, EM 200-1-3. Appendix F. February.

U. S. Environmental Protection Agency. 1992. National Enforcement Investigations Center. *Multi-Media Investigation Manual*, EPA-330/9-89-003-R. p. 85. Revised March.

_____. Region IV. 2001. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*. Athens, Georgia. November.

CDM Standard Operating Procedure

Project-Specific Modification

SOP No.: 4-5

SOP Title: Field Equipment Decontamination at Nonradioactive Sites

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/7/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Site-specific procedures for decontamination of Libby amphibole asbestos contaminated field equipment are different than CDM Technical SOP 4-5. These modifications are necessary for the entire duration of the project.

All equipment used to collect, handle, or measure soil samples will be decontaminated in accordance with CDM Technical SOP 4-5, Field Equipment Decontamination at Nonradioactive Sites, with the following modifications:

Section 4.0, Required Equipment - Plastic sheeting will not be used during decontamination procedures. American Society for Testing and Materials (ASTM) Type II water will not be used. Rather, locally available deionized (DI) water will be used.

Section 5.0, Procedures - Decontamination water will not be captured and will be discharged to the ground at the property.

Section 5.6, Waste Disposal - Decontamination water will not be captured and will not be packaged, labeled, or stored as investigation-derived waste (IDW).

Field Equipment Decontamination at Nonradioactive Sites

SOP 4-5
Revision: 7
Date: March 2007

Prepared: Steven Fundingsland

Technical Review: Mike Higman

E-Signed by Michael C. Malloy
VERIFY authenticity with ApproveIt

QA Review: Jo Nell Mullins

Approved:

Signature/Date

E-Signed by P. Michael Schwan
VERIFY authenticity with ApproveIt

Issued:

Signature/Date

1.0 Objective

The objective of this standard operating procedure (SOP) is to describe the general procedures required for decontamination of field equipment at nonradioactive sites. This SOP serves as a general guide and is applicable at most sites; however, it shall be noted that site-specific conditions (i.e., type of contamination, type of media sampled), the governing agency (e.g., EPA, DOE, USACE), and site-specific work plans, sampling and analysis plans and/or quality assurance (QA) project plans may require modifications to the decontamination procedures provided in this SOP. Decontamination of field equipment is necessary to ensure acceptable quality of samples by preventing cross contamination. Further, decontamination reduces health hazards and prevents the spread of contaminants offsite.

2.0 Background

2.1 Definitions

Acid Rinse - A solution of 10 percent nitric or hydrochloric acid made from reagent grade acid and analyte-free water.

Analyte-Free Water - Tap water that has been treated so that the water contains no detectable heavy metals or other inorganic compounds. Analyte-free water shall be stored only in clean glass, stainless steel, or plastic containers that can be closed when not in use.

Clean - Free of contamination and when decontamination has been completed in accordance with this SOP.

Cross Contamination - The transfer of contaminants through equipment or personnel from the contamination source to less contaminated or noncontaminated samples or areas.

Decontamination - The process of rinsing or otherwise cleaning the surfaces of equipment to rid them of contaminants and to minimize the potential for cross contamination of samples or exposure of personnel.

Material Safety Data Sheets (MSDS) - These documents discuss the proper storage and physical and toxicological characteristics of a particular substance used during decontamination. These documents, generally included in site health and safety plans, shall be kept on site at all times during field operations.

Organic-Free/Analyte-Free Water - Tap water that has been treated so that the water meets the analyte-free water criteria and contains no detectable organic compounds. Organic-free/analyte-free water shall be stored only in clean glass, Teflon™, or stainless steel containers that can be closed when not in use.

Potable Water - Tap water may be obtained from any municipal system. Chemical analysis of the water source may be required before it is used.

Sampling Equipment - Equipment that comes into direct contact with the sample media. Such equipment includes split spoon samplers, well casing and screens, and spatulas or bowls used to homogenize samples.

Soap - Low-sudsing, nonphosphate detergent such as Liquinox™.

Solvent Rinse - Pesticide grade, or better, isopropanol, acetone, or methanol.

2.2 Associated Procedures

- CDM Federal SOP 1-1 - *Surface Water Sampling*
- CDM Federal SOP 1-3 - *Surface Soil Sampling*
- CDM Federal SOP 1-4 - *Subsurface Soil Sampling*
- CDM Federal SOP 1-5 - *Groundwater Sampling Using Bailers*
- CDM Federal SOP 1-7 - *Wipe Sampling*
- CDM Federal SOP 1-9 - *Tap Water Sampling*
- CDM Federal SOP 1-11 - *Sediment/Sludge Sampling*
- CDM Federal SOP 2-2 - *Guide to Handling Investigation-Derived Waste*
- CDM Federal SOP 3-1 - *Geoprobe® Sampling*

3.0 Responsibilities

The project manager or designee, generally the field team leader (FTL), ensures that field personnel are trained in the performance of this procedure and that decontamination is conducted in accordance with this SOP and site-specific work plans. The FTL may also be required to collect and document rinsate samples (also known as equipment blanks) to provide quantitative verification that these procedures have been correctly implemented.

Note: Responsibilities may vary from site to site. Therefore, all field team member responsibilities shall be defined in the field plan or site-/project-specific QA plan.

4.0 Required Equipment

- Stiff-bristle scrub brushes
- Plastic buckets and troughs
- Soap
- Nalgene or Teflon sprayers or wash bottles or 2- to 5-gallon, manual-pump sprayer (pump sprayer material must be compatible with the solution used)
- Plastic sheeting, plastic bags, and/or aluminum foil to keep decontaminated equipment clean between uses
- Disposable wipes, rags, or paper towels
- Potable water*
- Analyte-free water
- Organic-free/analyte-free water
- Gloves, safety glasses, and other protective clothing as specified in the site-specific health and safety plan
- High-pressure pump with soap dispenser or steam-spray unit (for large equipment only)
- Appropriate decontamination solutions pesticide grade or better and traceable to a source (e.g., 10 percent and/or 1 percent nitric acid [HNO_3], acetone, methanol, isopropanol, hexane)
- Tools for equipment assembly and disassembly (as required)
- 55-gallon drums or tanks for temporary storage of decontamination water (as required)
- Pallets for drums or tanks holding decontamination water (as required)

* Potable water may be required to be tested for contaminants before use. Check field plan for requirements.

5.0 Procedures

All reusable equipment (nondedicated) used to collect, handle, or measure samples shall be decontaminated before coming into contact with any sampled media or personnel using the equipment. Decontamination of equipment shall occur either at a central decontamination station or at portable decontamination stations set up at the sampling location, drill site, or monitoring well location. The centrally located decontamination station shall include an appropriately sized bermed and lined area on which equipment decontamination shall occur and shall be equipped with a collection system and storage vessels. In certain circumstances, berming is not required when small quantities of water are being generated and for some short duration field activities (i.e., pre-remedial sampling). Equipment shall be transported to and from the decontamination station in a manner to prevent cross contamination of equipment and/or area. Precautions taken may include enclosing augers in plastic wrap while being transported on a flatbed truck.

The decontamination area shall be constructed so that contaminated water is either collected directly into appropriate containers (5-gallon buckets or steel wash tubs) or within the berms of the decontamination area that then drains into a collection system. Water from the collection system shall be transferred into 55-gallon drums or portable tanks for temporary storage. Typically, decontamination water shall be staged until sampling results or waste characterization results are obtained and evaluated and the proper disposition of the waste is determined (SOP 2-2, *Guide to Handling Investigation-Derived Waste*). The exact procedure for decontamination waste disposal shall be discussed in the work plan. Also, solvent and acid rinse fluids may need to be segregated from other investigation-derived wastes.

All items that shall come into contact with potentially contaminated media shall be decontaminated before use and between sampling and/or drilling locations. If decontaminated items are not immediately used, they shall be covered either with clean plastic or aluminum foil depending on the size of the item. All decontamination procedures for the equipment being used are as follows:

General Guidelines

- Potable, analyte-free, and organic-free/analyte-free water shall be free of all contaminants of concern. Following the field QA sampling procedure described in the work plan, analytical data from the water source may be required.
- Sampling equipment that has come into contact with oil and grease shall be cleaned with methanol or other approved alternative to remove the oily material. This may be followed by a hexane rinse and then another methanol rinse. Regulatory or client requirements regarding solvent use shall be stated in the work plan.
- All solvents and acids shall be pesticide grade or better and traceable to a source. The corresponding lot numbers shall be recorded in the appropriate logbook.

  Note: Solvents and acids are potentially hazardous materials and must be handled, stored, and transported accordingly. Solvents shall never be used in a closed building. See the site-specific health and safety plan and/or the chemical's MSDS for specific information regarding the safe use of the chemical.
- Decontaminated equipment shall be allowed to air dry before being used.
- Documentation of all cleaning and field QA sampling shall be recorded in the appropriate logbook.
- Gloves, boots, safety glasses, and any other personnel protective clothing and equipment shall be used as specified in the site-specific health and safety plan.

5.1 Heavy Equipment Decontamination

Heavy equipment includes drilling rigs, well development rigs, and backhoes. Follow these steps when decontaminating this equipment:

- Establish a bermed decontamination area that is large enough to fully contain the equipment to be cleaned. If available, an existing wash pad or appropriate paved and bermed area may be used; otherwise, use one or more layers of heavy plastic sheeting to cover the ground surface and berms. All decontamination pads shall be upwind of the area under investigation.
- With the rig in place, spray areas (rear of rig or backhoe) exposed to contaminated media using a hot water high-pressure sprayer. Be sure to spray down all surfaces, including the undercarriage.
- Use brushes, soap, and potable water to remove dirt whenever necessary.
- Remove equipment from the decontamination pad and allow it to air dry before returning it to the work site.
- Record the equipment type, date, time, and method of decontamination in the appropriate logbook.

- After decontamination activities are completed, collect all contaminated wastewater, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles. All receptacles containing contaminated items must be properly labeled for disposal as detailed in the field plan. Liquids and solids must be drummed separately.

5.2 Downhole Equipment Decontamination

Downhole equipment includes hollow-stem augers, drill pipes, rods, stems, etc. Follow these steps when decontaminating this equipment:

- Set up a centralized decontamination area, if possible. This area shall be set up to collect contaminated rinse waters and to minimize the spread of airborne spray.
- Set up a "clean" area upwind of the decontamination area to receive cleaned equipment for air-drying. At a minimum, clean plastic sheeting must be used to cover the ground, tables, or other surfaces on which decontaminated equipment is to be placed. All decontamination pads shall be upwind of any areas under investigation.
- Place the object to be cleaned on aluminum foil or plastic-covered wooden sawhorses or other supports. The objects to be cleaned shall be at least 2 feet above the ground to avoid splashback when decontaminating.
- Using soap and potable water in the hot water high-pressure sprayer (or steam unit), spray the contaminated equipment. Aim downward to avoid spraying outside the decontamination area. Be sure to spray inside corners and gaps especially well. Use a brush, if necessary, to dislodge dirt.
- If using soapy water, rinse the equipment using clean, potable water. If using hot water, the rinse step is not necessary if the hot water does not contain a detergent. If the hot water contains a detergent, this final clean water rinse is required.
- Using a suitable sprayer, rinse the equipment thoroughly with analyte-free water.
- Remove the equipment from the decontamination area and place in a clean area upwind to air dry.
- Record equipment type, date, time, and method of decontamination in the appropriate logbook.
- After decontamination activities are completed, collect all contaminated wastewaters, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles. All receptacles containing contaminated items must be properly labeled for disposal. Liquids and solids must be drummed separately.

5.3 Sampling Equipment Decontamination

Follow these steps when decontaminating sampling equipment:

- Set up a decontamination line on plastic sheeting. The decontamination line shall progress from "dirty" to "clean." A clean area shall be established upwind of the decontamination wash/rinse activities to dry the equipment. At a minimum, clean plastic sheeting must be used to cover the ground, table, or other surfaces that the decontaminated equipment is placed for drying.
- Disassemble any items that may trap contaminants internally. Do not reassemble the items until decontamination and air drying are complete.
- Wash the items with potable water and soap using a stiff brush as necessary to remove particulate matter and surface films. The items may be steam cleaned using soap and hot water as an alternative to brushing. ***Note:* Polyvinyl chloride or plastic items shall not be steam cleaned.** Items that have come into contact with concentrated and/or oily contaminants may need to be rinsed with a solvent such as hexane and allowed to air dry prior to this washing step.
- Thoroughly rinse the items with potable water.

- If sampling for metals, thoroughly rinse the items with an acid solution (e.g., 10 percent nitric acid) followed by a rinse using analyte-free water. If sampling for organic compounds, thoroughly rinse the items with solvent (e.g., isopropanol) followed by a rinse using analyte-free water. The specific chemicals used for the acid rinse and solvent rinse phases shall be specified in the work plan. The acid rinsate and solvent rinsate must each be containerized separately. Acids and solvents are potentially hazardous materials and care must be exercised when using these chemicals to prevent adverse health affects (e.g., skin burns, irritation to the eyes and respiratory system). Appropriate personal protective equipment must be worn when using these chemicals. These chemicals (including spent rinsate) must be managed and stored appropriately. Special measures such as proper labels, paperwork, notification, etc. may be required when transporting or shipping these chemicals.
- Rinse the items thoroughly using organic-free/analyte-free water.
- Allow the items to air dry completely.
- After drying, reassemble the parts as necessary and wrap the items in clean plastic wrap or in aluminum foil.
- Record equipment type, date, time, and method of decontamination in the appropriate logbook.
- After decontamination activities are completed, collect all contaminated waters, used solvents and acids, plastic sheeting, and disposable personal protective equipment. Place the contaminated items in properly labeled drums for disposal. Liquids and solids must be drummed separately. Refer to site-specific plans for labeling and waste management requirements.

5.4 Pump Decontamination

Follow the manufacturer's recommendation for specified pump decontamination procedures. At a minimum, follow these steps when decontaminating pumps:

- Set up the decontamination area and separate "clean" storage area using plastic sheeting to cover the ground, tables, and other surfaces. Set up four containers: the first container shall contain dilute (nonfoaming) soapy water, the second container shall contain potable water, the third container shall be empty to receive wastewater, and the fourth container shall contain analyte-free water.
- The pump shall be set up in the same configuration as for sampling. Submerge the pump intake (or the pump, if submersible) and all downhole-wetted parts (tubing, piping, foot valve) in the soapy water of the first container. Place the discharge outlet in the wastewater container above the level of the wastewater. Pump soapy water through the pump assembly until it discharges to the waste container. Scrub the outside of the pump and other wetted parts with a metal brush.
- Move the pump assembly to the potable water container while leaving discharge outlet in the waste container. All downhole-wetted parts must be immersed in the potable water rinse. Pump potable water through the pump assembly until it runs clear.
- Move the pump intake to the analyte-free water container. Pump the water through the pump assembly. Pump the volume of water through the pump specified in the field plan. Usually, three pump-and-line-assembly volumes shall be required.
- Decontaminate the discharge outlet by hand, following the steps outlined in Section 5.3.
- Remove the decontaminated pump assembly to the clean area and allow it to air dry upwind of the decontamination area. Intake and outlet orifices shall be covered with aluminum foil to prevent the entry of airborne contaminants and particles.
- Record the equipment type, serial number, date, time, and method of decontamination in the appropriate logbook.

5.5 Instrument Probe Decontamination

Instrument probes used for field measurements such as pH meters, conductivity meters, etc. shall be decontaminated between samples and after use with analyte-free, or better, water.

5.6 Waste Disposal

Refer to site-specific plans and SOP 2-2 for waste disposal requirements. The following are guidelines for disposing of wastes:

- All wash water, rinse water, and decontamination solutions that have come in contact with contaminated equipment are to be handled, packaged, labeled, marked, stored, and disposed of as investigation-derived waste.
- Small quantities of decontamination solutions may be allowed to evaporate to dryness.
- If large quantities of used decontamination solutions shall be generated, each type of waste shall be contained in separate containers.
- Unless otherwise required, plastic sheeting and disposable protective clothing may be treated as solid, nonhazardous waste.
- Waste liquids shall be sampled, analyzed for contaminants of concern in accordance with disposal regulations, and disposed of accordingly.

6.0 Restrictions/Limitations

Nitric acid and polar solvent rinses are necessary only when sampling for metals or organics, respectively. These steps shall not be used, unless required, because of the potential for acid burns and ignitability hazards.

If the field equipment is not thoroughly rinsed and allowed to completely air dry before use, volatile organic residue, which interferes with the analysis, may be detected in the samples. The occurrence of residual organic solvents is often dependent on the time of year sampling is conducted. In the summer, volatilization is rapid, and in the winter, volatilization is slow. Check with your EPA region, state, and client for approved decontamination solvents.

7.0 References

American Society for Testing and Materials. 2002. *Standard Practice for Decontamination of Field Equipment at Nonradioactive Waste Sites*, ASTM D5088-02. January 10.

Department of Energy. Hazardous Waste Remedial Actions Program. 1996. *Standard Operating Procedures for Site Characterization*, DOE/HWP-100/R1. September.

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U. S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001.1.

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Control of Measurement and Test Equipment

SOP 5-1
Revision: 8
Date: March 2007

Prepared: Dave Johnson

Technical Review: Steve Guthrie

E-Signed by Michael C. Malloy
VERIFY authenticity with ApproveIt

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E-Signed by P. Michael Schwan
VERIFY authenticity with ApproveIt

Approved:

Signature/Date

Issued:

Signature/Date

1.0 Objective

The objective of this standard operating procedure (SOP) is to establish the baseline requirements, procedures, and responsibilities inherent to the control and use of all measurement and test equipment (M&TE). Contractual obligations may require more specific or stringent requirements that must also be implemented.

2.0 Background

2.1 Definitions

Traceability - The ability to trace the history, application, or location of an item and like items or activities by means of recorded identification.

2.2 Associated Procedures

- CDM Federal Technical SOP 4-1, *Field Logbook Content and Control*
- CDM Quality Procedures (QPs) 2.1 and 2.3
- Manufacturer's operating and maintenance and calibration procedures

2.3 Discussion

M&TE may be government furnished (GF), rented or leased from an outside vendor, or purchased. It is essential that measurements and tests resulting from the use of this equipment be of the highest accountability and integrity. To facilitate that, the equipment shall be used in full understanding and compliance with the instructions and specifications included in the manufacturer's operations and maintenance and calibration procedures and in accordance with any other related project-specific requirements.

3.0 Responsibilities

All staff with responsibility for the direct control and/or use of M&TE are responsible for being knowledgeable of and understanding and implementing the requirements contained herein as well as any other related project-specific requirements.

The project manager (PM) or designee (equipment coordinator, quality assurance coordinator, field team leader, etc.) is responsible for initiating and tracking the requirements contained herein.

Note: Responsibilities may vary from site to site. Therefore, all field team member responsibilities shall be defined in the field plan or site-/project-specific quality assurance plan.

4.0 Requirements for M&TE

- Determine and implement M&TE related project-specific requirements
- The maintenance and calibration procedures must be followed when using M&TE
- Obtain the maintenance and calibration procedures if they are missing or incomplete
- Attach or include the maintenance and calibration procedures with the M&TE
- Prepare and record maintenance and calibration in an equipment log or a field log as appropriate (Figure 1)
- Maintain M&TE records
- Label M&TE requiring routine or scheduled calibration (when required)
- Perform maintenance and calibration using the appropriate procedure and calibration standards
- Identify and take action on nonconforming M&TE

5.0 Procedures

5.1 Determine if Other Related Project-Specific Requirements Apply

For all M&TE:
The PM or designee shall determine if M&TE related project-specific requirements apply. If M&TE related project-specific requirements apply, obtain a copy of them and review and implement as appropriate.

5.2 Obtain the Operating and Maintenance and Calibration Documents

For GF M&TE that is to be procured:
Requisitioner - Specify that the maintenance and calibration procedures be included.

For GF M&TE that is acquired as a result of a property transfer:
Receiver - Inspect the M&TE to determine whether maintenance and calibration procedures are included with the item. If missing or incomplete, order the appropriate documentation from the manufacturer.

For M&TE that is to be rented or leased from an outside vendor:
Requisitioner - Specify that the maintenance and calibration procedures, the latest calibration record, and the calibration standards certification be included. If this information is not delivered with the M&TE, ask the procurement division to request it from the vendor.

5.3 Prepare and Record Maintenance and Calibration Records

For all M&TE:
PM or Designee - Record all maintenance and calibration events in a field log unless other project-specific requirements apply.

For GF M&TE only (does not apply to rented or leased M&TE):
If an equipment log is a project specific requirement, perform the following:

Receiver - Notify the PM or designee for the overall property control of the equipment upon receipt of an item of M&TE.

PM or Designee and User:
- Prepare a sequentially page numbered equipment log for the item using the maintenance and calibration form (or equivalent) (Figure 1).
- Record all maintenance and calibration events in an equipment log.

5.4 Label M&TE Requiring Calibration

For GF M&TE only (does not apply to rented or leased M&TE):
If calibration labeling is a project specific requirement, perform the following:

PM or Designee:
- Read the maintenance and calibration procedures to determine the frequency of calibration required.
- If an M&TE item requires calibration before use, affix a label to the item stating "Calibrate Before Use."
- If an M&TE item requires calibration at other scheduled intervals, e.g., monthly, annually, etc., affix a label listing the date of the last calibration, the date the item is next due for a calibration, the initials of the person who performed the calibration, and a space for the initials of the person who shall perform the next calibration.

5.5 Operating, Maintaining or Calibrating an M&TE Item

For all M&TE:
PM or Designee and User - Operate, maintain, and calibrate M&TE in accordance with the maintenance and calibration procedures. Record maintenance and calibration actions in the equipment log or field log.

5.6 Shipment

For GF M&TE:
Shipper - Inspect the item to ensure that the maintenance and calibration procedures are attached to the shipping case, or included, and that a copy of the most recent equipment log entry page (if required) is included with the shipment. If the maintenance and calibration procedures and/or the current equipment log page (if required) is missing or incomplete, do not ship the item. Immediately contact the PM or designee and request a replacement.

For M&TE that is rented or leased from an outside vendor:
Shipper - Inspect the item to ensure that the maintenance and calibration procedures and latest calibration and standards certification records are included prior to shipment. If any documentation is missing or incomplete, do not ship the item. Immediately contact the procurement division and request that they obtain the documentation from the vendor.

5.7 Records Maintenance

For GF M&TE:
PM or Designee - Create a file upon the initial receipt of an item of M&TE or calibration standard. Organize the files by contract origin and by M&TE item and calibration standard. Store all files in a cabinet, file drawer, or other appropriate storage media at the pertinent warehouse or office location.

Receiver - Forward the original packing slip to the procurement division and a photocopy to the PM or designee.

PM or Designee and User:
- Maintain all original documents in the equipment file except for the packing slip and field log.
- File the photocopy of the packing slip in the M&TE file.
- Record all maintenance and calibration in an equipment log or field log (as appropriate). File the completed equipment logs in the M&TE records. Forward completed field logs to the PM for inclusion in the project files.

For M&TE rented or leased from an outside vendor:
Receiver - Forward the packing slip to the procurement division.

User:
- Forward the completed field log to the PM for inclusion in the project files.
- Retain the most current maintenance and calibration record and calibration standards certifications with the M&TE item and forward previous versions to the PM for inclusion in the project files.

5.8 Traceability of Calibration Standards

For all items of M&TE:
PM or Designee and User:
- When ordering calibration standards, request nationally recognized standards as specified or required. Request commercially available standards when not otherwise specified or required. Or, request standards in accordance with other related project-specific requirements.
- Require certifications for standards that clearly state the traceability.
- Require Material Safety Data Sheets to be provided with standards.
- Note standards that are perishable and consume or dispose of them on or before the expiration date.

5.9 M&TE That Fails Calibration

For any M&TE item that cannot be calibrated or adjusted to perform accurately:
PM or Designee
- Immediately discontinue use and segregate the item from other equipment. Notify the appropriate PM and take appropriate action in accordance with the CDM QP 2.3 for nonconforming items.
- Review the current and previous maintenance and calibration records to determine if the validity of current or previous measurement and test results could have been affected and notify the appropriate PM(s) of the results of the review.

6.0 Restrictions/Limitations

On an item-by-item basis, exemptions from the requirements of this SOP may be granted by the Headquarters health and safety manager and/or Headquarters quality assurance director. All exemptions shall be documented by the grantor and included in the equipment records as appropriate.

7.0 References

CDM Federal Programs Corporation. 2007. *Quality Assurance Manual.* Rev. 11.

CDM Federal Programs Corporation. 2005. *Government Property Manual.* Rev. 3.

Figure 1

CDM
A subsidiary of Camp Dresser & McKee Inc.

Maintenance and Calibration

Date: Time: (a.m./p.m.)

Employee Name:

Contract/Project:

Activity:

Equipment Description:

Equipment ID No.:

Equipment Serial No.:

Maintenance

Maintenance Performed:

Comments:

Signature: Date:

Calibration/Field Check

Calibration Standard:

Lot No. of Calibration Standard:

Pre-Calibration Reading:

Additional Readings:

Additional Readings:

Pre-Field Check Reading:

Concentration of Standard:

Expiration Date of Calibration Standard:

Post-Calibration Reading:

Additional Readings:

Additional Readings:

Post-Field Check Reading:

Adjustment(s):

Calibration: □ Passed □ Failed

Comments:

Signature: Date:

Project-Specific Standard Operating Procedure
Libby Asbestos Project

SOP No.: CDM-LIBBY-09, Revision 0
SOP Title: Global Positioning Satellite (GPS) Coordinate Collection and Handling
Project: Libby Asbestos Project
Project No.: 2616
Client: U.S. Department of Transportation (DOT)/Volpe Center

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1.0 Objective

The objective of this standard operating procedure (SOP) is to provide a standardized approach for the collection and handling of GPS data at the Libby Asbestos Site (Site).

2.0 Background

2.1 Definitions

Libby_Sampling Data Dictionary - All Trimble handheld units used at the Site are pre-programmed with the Libby _Sampling data dictionary, specific to the spatial data collection needs for the Libby Asbestos Project. All personnel required to collect GPS data will be familiar with the contents of the Libby_Sampling data dictionary, which contains the following features: Soil Sample, Air Sample, Dustfall (Settled Dust) Sample, Water/Sediment Sample, Building Location, Interest Point, Sample Area, and Interest Area. The Trimble units also are loaded with a generic data dictionary that handles collection of generic lines, points and areas.

2.2 Discussion

The following attributes are required to be collected as indicated in Table 1 for each feature type when a GPS coordinate is collected:

Table 1 – Attributes Collected in the Libby_Sampling Data Dictionary

Feature Name	Attributes Collected
Building Location	LocationID, Address, Comments
Soil Sample	LocationID, IndexID, Sample_Type, SamplGroup, Upper_Depth, Lower_Depth, Comment
Air and Dustfall Samples	LocationID, IndexID, Sample_ Type, SamplGroup , Comment
Water/Sediment Sample	LocationID, IndexID, Matrix_Type, Comment
Interest Point	Location, Land_Use, Comment
Interest Area	Location, Land_Use, Comment
Sample Area	LocationID, IndexID, Num_of _Composites, Upper_Depth, Lower_Depth, Comment

These attributes are discussed in detail in Section 4 of this document.

3.0 Responsibilities

GPS data is collected by investigation, pre-design, and removal oversight staff as specified in the sampling and analysis plans specific to those programs. Transfer of GPS data from the field

equipment to the onsite server, as well as initial data review, processing, and transmittal of data off-site will be performed by a designated on-site IMS staff member during peak field season (April through November), and by administrative support staff during the off season. These additional procedures are documented separately and are posted on CDM's e-room at: https://team.cdm.com/eRoom/R8-RAC/Libby/0_290a.

4.0 Procedures

The following sections describe how GPS points are collected and handled for features commonly used at the Site.

4.1 GPS Point Collection

Building Locations

For building locations, a GPS point is collected near the front door or main entrance of the building. Location IDs beginning with the prefix "BD" (indicating a building point), are used for such locations.

Soil Samples

For **Grab** samples, a GPS point is collected directly above the location where each sample is collected. Location IDs beginning with the prefix "SP" (indicating a sample point), are used for such locations.

For **Composite** samples, a GPS point is collected at the approximate center of each sample area. In the case of an irregular-shaped sample area or sample area that is non-continuous (e.g., a flowerbed that wraps around a house), a GPS point is collected at the center of the largest continuous sample area. Location IDs beginning with the prefix "SP" are used for such locations.

Outdoor Stationary Air and Dustfall (Settled Dust) Samples

For permanent (i.e., samples represent a consistent monitoring zone or area and are collected on a routine schedule) outdoor stationary air and dustfall sample locations, a GPS point is collected at each unique sample location. All subsequent samples taken at that location will be assigned the same Location ID and X,Y coordinates. The GPS point is only collected once. Location IDs beginning with the prefix "SP" (indicating a sample point), are used for such locations.

GPS points are **not** collected for the following features:

- Stationary air, dust, and soil samples collected inside or beneath structures (locations are associated with the X,Y coordinate of the building where the sample was collected)
- Stationary air samples, with the exception of permanent monitoring locations as designated in site-specific removal work plans or Response Action Work Plan Addenda
- Duplicate or Replicate air or dust samples (assigned the same location ID as the parent sample)
- Soil samples taken at depth from the same X,Y location as a previously collected sample. The at-depth soil sample will be assigned the same Location ID as the shallower sample in order to relate both samples to the same X,Y coordinate.
- Duplicate or split soil samples (assigned the same location ID as the parent sample)
- Personal air samples (locations are associated with the X,Y coordinate of the building or property where the sample was collected)

Interest Point, Interest Area, Sample Area
GPS points for these features are not routinely collected on the Libby Asbestos Project. However, they are included in the Libby_Sampling data dictionary in the event that a GPS point is collected for an area where no sampling is involved, or a series of points is collected to document the perimeter of an interest area or sample area.

4.2 Operation of Trimble Pro XRS and GeoXT Handheld Units:

Operators must be standing at the sample location *before* the unit starts to collect positions. Once the unit has started collecting positions, the operator must remain standing at the sample location until the minimum required positions have been collected. A minimum of **30** positions will be collected for each GPS location. More positions will be required in circumstances where the position dilution of precision (PDOP) is greater than the default setting of 4.5. Plan GPS collection around satellite availability & times when PDOP is < 4.5.

Record-keeping Requirements:

Serial numbers of the Trimble datalogger, receiver, and antenna will be recorded in a field logbook. GPS filenames will be recorded in the logbook and on field sample data sheets (FSDSs).

Data Collection Instructions for Trimble Pro XRS:

Turn on the unit and select *Data Collection* from the main menu. You will be prompted to create a new file, open an existing file, or create a base file. Choose *create new file* and press Enter. There will be a generic default file name that begins with "*RO...*" followed by the date. Create a new file name using the following naming convention: **T1A10204**, where **T1** refers to the specific Trimble unit you are using, **A** refers to the first file of the day (**B** would be the second file of the day, and so on), and **10204** refers to October 20, 2004. You are limited to only 8 characters so the date notation will be MMDDY. The setting for data dictionary should always be set to Libby_Sampling. Press Enter to bring up the Start Feature menu.

From the Start Feature menu you will select the type of location data that you want to collect. Press the F1 key to pause the unit until you are ready to start collecting data. Highlight the appropriate data type and press Enter. (Note, if you do not have the unit paused it will start collecting data as soon as you press Enter.) Using the alphanumeric keypad and the directional keypad enter the *Index* and *Location ID* exactly as they appear on the printed labels. Under the *Sample Type* field you will see an arrow indicating a drop-down menu with preset options. If you scroll to the right while *Sample Type* is highlighted you will see the available options. Select the option you want and then scroll to the right again to exit the drop down menu.

Enter any additional information such as Owner, Sample Grid, Sample Location, etc. in the *Comments* field. Press the F1 key to *resume* collecting positions. The unit will beep for every position it collects displaying the total positions in the lower right corner. After the counter has reached the desired number of positions (30 positions), press Enter and then F1 to confirm and save your data point. Repeat this process for every new location.

Review all entries and correct any mistakes before downloading. You can view and edit the data you have collected by pressing F2 (*Review*) from the Start Feature menu. Use the directional pad to scroll through the locations and press Enter to view the sample information.

If changes are made to the data, be sure to press Enter to save the changes, otherwise just press Esc. Press F2 (*New*) to return to the Start Feature menu.

Additional useful handheld features:

- **Review feature** - allows you to quickly view keyed data for errors, making changes as necessary.
- **Repeat feature** - saves time & reduces keystroke errors when collecting multiple samples of the same type.
- **Offset** - reduces the headache and extra time associated with trying to capture GPS data under bridges, large trees, porches, facades and awnings, or while standing close to a building or other object that can deflect satellites signals from the GPS receiver.
- **Delete Feature** - allows you to delete a feature from a file if, for example, no positions were collected or the sample is voided. This will save time & confusion during the QC process.
- **Rename File** - will allow you to browse through the file names you have created, and quickly edit them if necessary. This will save time if it is done *before* the files are downloaded.
- **Delete File** - will allow you to delete a file from the handheld when necessary. This will save time during the QC process if it is done *before* the files are downloaded.

Data Collection Instructions for Trimble GeoXT:

Turn on the unit and with the stylus, select *GPS* from the lower right menu. This will open the Terra Sync software. Wait for the GPS status screen to recognize at least 4 satellites. Depending on your location, this can take several minutes. If you do not wait long enough, you will you not succeed in collecting your data. The connected satellite names will appear on the left side of the screen – they will be highlighted to indicate that they are connected. Select *Data* from the drop down menus at upper left. There will be a generic default file name that begins with "*RO...*" followed by the date. Create a new file name using the following naming convention: **T1A10204**, where **T1** refers to the specific Trimble unit you are using, **A** refers to the first file of the day (**B** would be the second file of the day, and so on), and **10204** refers to October 20, 2004. You are limited to only 8 characters so the date notation will be MMDDY. The setting for data dictionary should always be set to Libby_Sampling. Select *Create*. Confirm the antennae height by selecting *ok*. Highlight the appropriate feature name and select *Create*. The unit will begin logging the point automatically. Enter the attribute data using the stylus and the keyboard icon located at the bottom of the touch screen. When you are finished recording, hit *ok*, which saves the file and location information. If you have other points to collect within the same file, select the *Options* menu then select *Repeat*.

4.3 GPS Data Transfer

GPS File Transfer to Libbysvr02 from Trimble Pro XRS

- Turn on the Trimble Unit
- *The unit will try to connect to the GPS receiver* - press the **Esc** button
- Select **File Manager**
- Select **File Transfer** - *currently the data consists of .ssf files and is transferred to Libbysvr02\Pfdata\Libby - the file is named with an 8character identifier: T+TrimbleUnitNo+ file number(A for first file collected that day)+mmddy*
- Open Pathfinder Office

- Select **Utilities**
- Select **Data Transfer**
- Select **Add**
- Select **Datafile** – *Pathfinder will search for a connection to the Trimble Unit*
- Connect the cable from the computer to the Trimble Unit
- A list of files will appear when the connection is complete
- Select **Open**
- Select **Transfer All**
- When the download is complete, close the data transfer window – *if downloading files from several units, close and reopen this window between downloads*
- Delete files from the Trimble Unit – *all of the files will be listed - double check that all the files were transferred to libbysvr02 before deleting*

GPS File Transfer to Libbysvr02 from Trimble Pro GeoXT

The Trimble GeoXT connects to a PC through the charger unit using a USB cable *(type A to type B)*, and Microsoft Active Sync software. *(There are Active Sync connection settings to enable or disable once the device is connected to the PC. From the Active Sync menu, select Tools, select Options. These connect the Trimble to other Windows applications on the PC eg; email, task managers, etc. The main reason to disable these settings at Libby, is that the Trimble Units are shared and it does not make sense to activate them.)*

- Turn on the Trimble Unit
- Select **GPS** - from lower right corner *(This opens up the TerraSync GPS software.)*
- Select **Setup**
- Select **Options**
- Select **Disconnect from GPS**
- Select **Data**
- At the bottom of list, select **File Manager**
- Open Pathfinder
- Select **Utilities**
- Select **Data Transfer**
- From the Device list, select **GIS Datalogger on Windows CE**
- Click on the connect icon (the button with the checkmark circled in green). *A picture on the right will indicate the connection status.*

4.4 Preliminary On-site Data Quality Control

Following the download of files from the Trimble units, a copy of each file is made and filed in *Libbysvr02 \ Pfdata \ Libby \ RawFiles*. The raw files are not modified but kept as the only copy of the complete set of original downloaded data files. Using the Pathfinder export utility, shapefiles (.shp) of the non-quality control checked (QC'd) files located in *Libbysvr02 \ Pfdata \ Libby* are exported. These shapefiles are opened in ArcMap. A new export file of the attribute tables from Arcmap is created and saved as a .dbf file, then opened and saved in Excel workbook format. The Excel file is imported as a new table into a recent copy of the Electronic Libby Asbestos Sample Tracking Information Center (eLASTIC). A report is generated linking the index_id of the imported table with the index_id of the eLASTIC sample

table. This report is saved in Excel. An Excel comparison function is used to compare location ids from the GPS files with the eLASTIC Location IDs. Any discrepancies are researched to determine if the error resides on the FSDS, was a data entry error in eLASTIC, or a data entry error in the GPS .ssf file. Errors in the .ssf files are corrected using Pathfinder Office. Files used for this data review process (.shp, .dbf files and .xls files) are not retained. The QC'd .ssf files are then emailed in a .zip file from the Libby Office to off-site GIS staff for processing. The QC'd and .zip files are moved to *Libbysvr02 \ Pfdata \ Libby \ QC and sent zip files.*

For reference on using Pathfinder export and ARCMap attribute tables see Eroom: Libby GIS folder: GPS to GIS procedure posted by Mike Schultz on August 29, 2006.

4.5 Equipment, Software & Configuration

For Trimble Pro XRS or Trimble GeoXT:

Software used for data transfer: GPS Pathfinder Office 2.90 and 3.10
TerraSync

Software used for on-site QC: GPS Pathfinder Office 2.90 and 3.10
ArcGIS ArcMap
Microsoft Excel
eLASTIC

Configuration Settings (TSC1 5.27 software)
Software can vary with rental equipment. Some settings can be changed to accommodate data collection needs.

Table - 2 Configuration Settings for Trimble Pro XRS		
GPS Rover Options - Logging Options		
Logging Intervals	Point feature	1 s
	Line / area	3 s
	Not in feature	none
	Velocity	none
Confirm end feature	no	
Minimum Positions	30	
Carrier phase	Carrier mode	off
	Minimum time	10mins
GPS Rover Options – Position Filters		
Position mode	Manual 3D	
Elevation mask	15 degrees	
SNR mask	6.0	
DOP type	PDOP	
PDOP mask	6.0	
PDOP switch	4.0	
GPS Rover Options – Real-time input		
Preferred correction source	use uncorrected GPS	
GPS Rover Options – General real-time settings		
Correction age limit	10s	
GPS Rover Options – Antenna options		
Height	6.000USft	

Measure	Vertical	
Confirm	Never	
Type	Integrated GPS/ Beacon/Sat	
Part number	33580-50	
GPS Rover Options – Initial Position		
North	USft	
East	USft	
GPS Rover Options – 2D altitude		
Altitude(MSL)	USft	
Computed at	time	
Computed at	date	
GPS Base Station Options – Logging Options		
Logging Intervals	Measurements	5s
	Positions	30s
Audible Click	Yes	
Log DOP data	Yes	
GPS Base Station Options – Position Filters		
Position mode	Manual 3D	
Elevation mask	15 degrees	
SNR mask	4.0	
PDOP mask	6.0	
PDOP switch	4.0	
GPS Base Station Options – Real-time output options		
Real-time output mode	off	
Radio type	Custom	
Baud rate	9600	
Data bits	8	
Stop bits	1	
Parity	Odd	
RTCM options	Station	1
	Message type	Type 1
	Message interval	5s
	Message suffix	None
	CTS flow control	Off
	CTS xmit delay	0ms
	RTS mode	High
	RTS edge delay	0ms
GPS Base Station Options – Reference position		
Datum	NAD 1983 (Conus)	
Zone	11 North	
NMEA/TSIP Output options		
Output	TSIP	
Baud rate	38400	
Coordinate System	UTM	
Map display options	All show with no background	
Units and Display		
Units	Distance(2D)	US Survey Ft
	Area	Square feet
	Velocity	Miles/Hour
	Angle format	DDMMSSss
	Order	North/East
	North reference	True
	Magnetic declination	Auto

	Null string	
	Language	English
Time and Date	24 hour clock	Yes
	Time	##:##:##
	Date format	MM/DD/YYYY
	Date	MM/DD/YY weekday
Quickmarks	Attributes	Repeat
	Confirm	No
Hardware(TSC1) software version 5.27		

Table - 3 Libby Sampling Data Dictionary
"Libby Sampling", Dictionary
"Soil Sample", point, "", 1, seconds, 1, Code
"LocationID", text, 30, required, "SP-000001", required, SP-
"IndexID", text, 30, required, required, Label1
"Sample_Type", menu, required, required, Label2
"COMPOSITE", default
"GRAB"
"SamplGroup", menu, required, required
"BARN"
"BARROW SOURCE"
"BASEMENT"
"BLANK"
"DRIVEWAY"
"FIELD"
"FLOWER BED"
"GARAGE"
"GARDEN"
"HOUSE"
"PARK"
"PROPERTY"
"ROAD"
"SCHOOL"
"SHED"
"WALKWAY"
"YARD", default
"STOCKPILE"
"Upper_Depth", text, 30, required, "Inches", required
"Lower_Depth", text, 30, required, "Inches", required
"Comment", text, 30, normal, normal
"Air Sample", point, "", 1, seconds, 1, Code
"LocationID", text, 30, required, required
"IndexID", text, 30, required, required, Label1
"Sample_Type", menu, required, required, Label2
"PERSONAL"
"STATIONARY", default
"SamplGroup", menu, required, required
"BARN"
"BARROW SOURCE"
"BASEMENT"
"BLANK"
"DRIVEWAY"
"FIELD"

```
    "FLOWER BED"
    "GARAGE"
    "GARDEN"
    "HOUSE", default
    "PARK"
    "PROPERTY"
    "ROAD"
    "SCHOOL"
    "SHED"
    "WALKWAY"
    "YARD"
  "Comment", text, 30, normal, normal

"Dustfall Sample", point, "", 1, seconds, 1, Code
  "LocationID", text, 30, required, required, Label1
  "IndexID", text, 30, required, required, Label2
  "Sample_Type", menu, required, required
    "BUILDING", default
    "VEHICLE"
    "NA"
    "OTHER"
  "SamplGroup", menu, required, required
    "BARN"
    "BARROW SOURCE"
    "BASEMENT"
    "BLANK"
    "DRIVEWAY"
    "FIELD"
    "FLOWER BED"
    "GARAGE"
    "GARDEN"
    "HOUSE", default
    "PARK"
    "PROPERTY"
    "ROAD"
    "SCHOOL"
    "SHED"
    "WALKWAY"
    "YARD"
    "STOCKPILE"
  "Comment", text, 30, normal, normal

"Building Location", point, "", 1, seconds, 1, Code
  "LocationID", text, 30, required, "BD-000001", required, BD-, Label1
  "Address", text, 50, required, normal, Label2
  "Comments", text, 30, normal, normal

"Water_Sedmnt Sample", point, "", 1, seconds, 1, Code
  "LocationID", text, 30, required, required, Label1
  "IndexID", text, 30, required, required, Label2
  "Matrix_Type", menu, required, required
    "Surface"
    "Well", default
  "Comment", text, 30, normal, normal
```

"Interest Point", point, "", 1, seconds, 1, Code
"Location", text, 30, required, required, Label1
"Land_Use", text, 30, required, required, Label2
"Comment", text, 30, normal, normal
"Interest Area", area, "", 3, seconds, Code
"Location", text, 30, required, required, Label1
"Land_Use", text, 30, required, required, Label2
"Comment", text, 30, normal, normal
"Sample Area", area, "For odd composits", 3, seconds, Code
"LocationID", text, 30, required, "SP-000001", required
"IndexID", text, 30, required, required, Label1
"Num_of_Composits", numeric, 0, 0, 100, 5, required, "Number of Composits", required, Label2
"Upper_Depth", text, 30, required, "Inches", required
"Lower_Depth", text, 30, required, "Inches", required
"Comment", text, 30, normal, normal

Site-Specific Sampling Guidance
Libby Superfund Site

Guidance No: CDM-LIBBY-10, Revision 1

Guidance Title: Collection of 30-Point Composite Microvacuum Dust Samples for Determining Nature and Extent of Libby Amphibole Asbestos (LA) in Indoor Dust

Approved by:

Technical Reviewer — Date: 5/10/07

QA Reviewer — Date: 5/10/07

Volpe Center Approval — Date: 05/10/07

EPA Approval — Date: 5/10/07

Section 1
Purpose

The purpose of this standard operating procedure (SOP) is to provide a consistent method for the collection of 30-point composite microvacuum dust samples. This SOP is to be used by contractors/subcontractors supporting EPA investigation activities at the Libby Superfund Site. This SOP describes the processes by which sample locations will be selected and the procedures used to collect samples. Samples collected according to this SOP can be used to determine the nature and extent of LA in indoor dust for assessing clean-up requirements.

Section 2
Responsibilities

Successful execution of this SOP requires a clear hierarchy of assigned roles with different sets of responsibilities associated with each role. All staff with responsibility for the collection of indoor dust samples is responsible for understanding and implementing the requirements contained herein as well as any other governing guidance documents.

Task Leader (TL) or Field Team Leader (FTL) - The TL or FTL is responsible for overseeing sample collection processes as described in EPA-approved governing guidance documents (i.e., site-specific sampling and analysis plans [SAPs], quality assurance project plans [QAPPs], etc.). The TL or FTL is also responsible for checking all work performed and verifying that the work satisfies the specific tasks outlined by this SOP and all governing guidance documents. The TL or FTL will communicate with the field team members regarding the specific collection objectives and anticipated situations that require deviation from this SOP. It is also the responsibility of the TL or FTL to communicate the need for any deviations from the SOP with the appropriate EPA personnel (team leader or their designate), and document the deviations using a Field Modification Form provided in each SAP or QAPP.

Field team members - Field team members performing the sampling described in this SOP are responsible for adhering to the applicable tasks outlined in this procedure while collecting samples at properties associated with the Libby Superfund Site. The field team members should have limited discretion with regard to collection procedures but should exercise judgment regarding the exact location of sample points, within the boundaries outlined by the TL or FTL.

Section 3
Equipment

This section provides a list of equipment required to collect dust samples according to the site-specific protocols detailed in Section 4 and to meet the requirements of American Society for Testing and Materials (ASTM) method D5755-03 (ASTM 2003).

- Sampling pump - The sample pump used in the collection of microvacuum dust samples will be capable of flow rates typically used for dust sampling, 2.0 liters per minute (L/min). The pump must be capable of providing a non-fluctuating air-flow through the sampling media, and maintain the initial flow-rate volume to within ±10 percent (%) throughout the sampling period.

- Rotameter - A rotameter will be used as a secondary calibration standard as required for verifying the flow rate of the sampling pump used for sample collection. The rotameter will be calibrated such that the operator can measure flow rates to ±5% accuracy at the expected flow rate. Each rotameter in use should be calibrated against a primary standard as required according to manufacture recommendations and governing guidance documents.

- Sample cassettes - The sample cassettes used for the collection of microvacuum dust samples at the Libby Superfund Site are a commercially available 25-millimeter (mm), three-piece cassette with a 50-mm electronically conductive extension cowl loaded with a 0.45 micrometer (µm) mixed cellulose ester (MCE) filter. The sampling nozzle attached to the cassette inlet will meet the following specifications as described in ASTM D5755-03 (ASTM 2003): the sampling end will be cut at a 45° angle, and the length of tubing will be at least 25 to 37 mm in length and 0.25 inches in diameter.

- Inert tubing - Tygon® tubing with a 3/16-inch inner diameter and 5/16-inch outer diameter is used in the sample collection train to connect the outflow end of the sample cassette to the sampling pump.

- Sample ID labels (Index IDs) - pre-printed index ID number labels are placed on the sampling cassette to indicate the unique sampling number assigned to the sample. Index ID labels can also be used in logbooks/PDAs and on other field forms for sample identification. The specific index ID numbers used will be detailed in governing guidance documents.

- Collection area templates - 10 by 10 centimeter (cm) reusable plastic or disposable cardstock (paper) templates are used to delineate each sample point. When a plastic template is used, it will be wiped with a disposable wet towel between each individual sample (i.e., not between individual aliquots). When a paper template is used, a new template will be used after each sample.

- Zip-top plastic bag - after sample collection is complete, each sample cassette will be placed in an individual zip-top plastic bag. The index ID label will be placed on the outside of the zip-top bag and affixed with clear tape if necessary. The index ID may also be written on the outside of the bag using a permanent marker (preferred). Sample cassettes are placed into individual bag to mitigate the potential for cross-contamination in the event that a cassette should open during handling or shipping.

- Field logbook or PDA -used to record progress of the sampling effort and record any problems and field observations.
- Cooler or other ridged container - used to store samples while in the field.
- Custody Seals - aid in ensuring the integrity of samples during handling or shipping.
- Latex or Nitrile Gloves – Worn during dust sample collection to prevent cross-contamination.

Section 4
Selection of Sample Locations

Governing guidance documents should be consulted to determine when microvacuum dust sampling is required.

When sampling is required, one 30-point composite sample will be collected on a single sampling cassette per living floor, or as required for secondary buildings. Each dust sample will be collected from areas classified on a scale of accessibility as described below:

1. **Accessible** areas refer to locations where exposures are most likely to occur – places where dust accumulates and is encountered daily. This includes soft surfaces such as carpet (not including movable floor mats), upholstered furniture, floors, and waist-high hard surfaces such as counter tops and non-carpeted floors.

2. **Infrequently accessed** areas refer to locations where dust may accumulate, but exposures are likely to occur infrequently. This includes areas on tops of shelves, entertainment centers, and refrigerators, etc.

3. **Inaccessible** areas refer to locations where dust may accumulate but exposures occur only rarely, such as behind refrigerators or other large infrequently moved objects.

To the extent possible, the sample point locations will be collected from each type of accessibility area as indicated below:

1. **Accessible** target areas, if present (as indicated, some locations described should only be included when visible dust can be observed with the unaided eye of the field team members):
    a. Flooring (soft or hard surface) at the main entrance used by occupants
    b. Flooring at the secondary or less heavily used entrance to the home
    c. Flooring in the center of the living room or family room
    d. Flooring in the center of bedrooms

e. Flooring in an acknowledged or evident route of high traffic (i.e., hallway or other thoroughfare)
f. Flooring in the kitchen
g. Kitchen counter tops, ***only when visible dust is observed***
h. Table tops in the following rooms: dining room, living room, or family room, ***only when visible dust is observed***
i. Table tops (e.g., night stands, bureaus) in bedrooms, ***only when visible dust is observed***
j. Window sills in the dining room, living room, or family room
k. Window sills in the bedrooms
l. Upholstered furniture in the living room

2. **Infrequent** target areas, if present:
   a. Top of the refrigerator, when top is exposed
   b. Top of bookshelves
   c. Shelves of bookshelves
   d. Top of the hot water heater
   e. Top of wood stoves
   f. Fireplace mantels and/or hearths
   g. Beneath the sofa or other large pieces of furniture in the living room
   h. Beneath the bed or other large pieces of furniture in bedrooms
   i. Inside kitchen cabinets most frequently accessed

3. **Inaccessible** target areas, if present:
   a. Beneath infrequently moved heavy appliances when accessible without moving the appliance (e.g., refrigerator, washing machine, dryers, dishwashers, etc.)
   b. Inside forced air floor or ceiling vents in the living room
   c. Inside forced air floor or ceiling vents in the bedrooms
   d. Inside forced air floor or ceiling vents in the kitchen or bathroom
   e. Corners of closets or other similar small areas not frequently accessed or cleaned

The preferred distribution of the 30-sample points among the three target areas described above is as follows:

- 12-sample points collected from **Accessible** target areas
- 12-sample points collected from **Infrequent** target areas
- 6-sample points collected from **Inaccessible** target areas

Sampling Contingencies

The preferred sample distribution may not always be achievable given the varying conditions of buildings at the Libby Superfund Site. This section discusses situations

when the preferred distribution may not be achieved and provides guidance to the field team members for determining how sample points should be distributed.

1. When the preferred distribution cannot be achieved due the lack of locations in a specific target area category, the remaining number of sampling locations required to reach a total of 30-sample points should be distributed among other target areas according to the preferred distribution ratio (2:2:1).

   For example: If 12 **Accessible** and 12 **Infrequent** target areas are identified and sampled, and only 2 **Inaccessible** target areas are identified and sampled; 4 points remain to be sampled so the total number of sample points adds to 30. The four remaining locations should be distributed evenly among **Accessible** and **Infrequent** target areas, with 2 sample locations collected from each area type.

   If the preferred distribution cannot be achieved, the number of sub-sampling points collected for the composite sample will be recorded as specificed by project specific guidance.

   When unfurnished areas, primary buildings, or secondary building require dust sampling, the locations selected for **Accessible** and **Infrequent** target areas should include flooring and all available horizontal surfaces. It may be necessary to collect several sample points from flooring within the same room in order to meet the overall goal of collecting 30points. The potential issues discussed in Sampling Contingency #1 also apply to this situation.

2. In some cases secondary buildings may be so small that 30 discrete sample points do not exist in the building. This is most likely to occur when dust sampling in a pump house or other similarly sized structure. When this situation is encountered, the field team member will record the number of locations that were obtained and document this deviation according the governing guidance document. The potential issues discussed in Sampling Contingency #1 also apply to this situation.

Section 5
Sample Procedures

Once sampling cassettes have been deemed usable via submittal of lot blanks to the analytical laboratory (see Section 8.2), each sample will be collected, after calibration of the sampling pump and identification of individual increments (sub-samples), according to the following procedures modified from ASTM D5755-03 (ASTM 2003):

1. Set-up the sampling train by attaching the sampling cassette to the sampling pump at the outlet side of the cassette with the required tubing. The length of tubing between the sampling cassette and the sampling pump should be long enough to allow sampling locations to be reached without interfering with the

operation of the sampling pump. If a pre-assembled cassette is used, remove the end cap. If a an inlet nozzle must be assembled:

a. Attach an unused portion of tubing, approximately 25.4 mm in length with an internal diameter of 6.35 mm, directly to the inlet orifice.

b. Cut the sampling end of the tubing at a 45° angle leaving a length of tubing between 25 mm and 37 mm between the inlet orifice and the cut end of the tubing.

2. Don latex or nitrile gloves.

3. Place a sampling template on the area to be sampled. Turn the sampling pump on and begin timing using a stopwatch. Each template (sub-sample location) should be sampled for approximately 30 seconds at a flow rate of 2.0 L/min. The field team member should strive to make three orthogonal collection passes per template during the 30second interval. During the collection period, the surface being sampled should not be scraped or abraded with the collection nozzle.

4. When the 30-second collection period has been completed, invert the sampling cassette so the collection nozzle is pointed upwards. Turn the sampling pump off and stop the stopwatch (do not clear the time from the watch).

5. Repeat sample collection as described in Steps 2 and 3 for the remaining sampling points collecting a cumulative time of collection (approximately 15 minutes) on the stopwatch.

6. During the dust sampling pilot, verify the flow rate after every 5th sampling location (5th, 10th, 15th, 20th, 25th, and 30th) according to the following:

a. Turn the sampling pump off.

b. Connect the rotameter in a calibration train. Ensure the rotameter is within 6° of vertical.

c. Turn the sampling pump on.

d. Record the observed flow rates on the rotameter according to governing guidance document.

e. If required, adjust the flow rate back to 2.0 L/min according to instructions provided for the specific the sampling pump in use.

f. Turn the sampling pump off.

g. Record the value of the ending flow rate according to the governing guidance documents.

The verification frequency may be reduced after experienced is gained during the collection activities.

After the pilot phase, verify the flow rate at the beginning and at the end of each sampling event for each floor.

7. After the last location has been sampled and the final flow rate recorded as described in Step 5, turn the sampling pump off and seal each end of the cassette with a cassette end-plug. This can be done with either the sampling nozzle left in place (preferred) or removed. If the nozzle is removed it should also be sealed at both ends with an end-plug and placed in a separate zip-top bag for shipment to the laboratory. The nozzle is always saved and rinsed at the laboratory during sample preparation because a significant percentage of the dust drawn from a lightly loaded surface may adhere to the inside walls of the tubing.

8. Record the total elapsed sample collection time and total area sampled and other information as required according to governing guidance documents.

9. Wipe off the exterior surface of the cassette with disposable wet towel.

10. Place a sample label (index ID) on the cassette that clearly identifies the sample's unique identification number on the cassette.

11. Place a sample custody seal around both ends of the sampling cassette in a manner that does not obstruct the sample label.

12. Place each sample cassette in an individual plastic zip-top bag. Each bag should be labeled indicating the sample index ID. Do not put the sample cassette in a shirt or coat pocket as the filter can pick up fibers from clothing.

13. Decontaminate sampling equipment as required by the governing guidance document.

14. Transport the samples in a ridged container to the sample coordinator or designated recipient.

Dust field duplicate samples will be collected at the frequency required in the governing guidance documents. Field duplicate samples will be collected immediately adjacent to the locations of the parent sample. The duplicate will be collected from the same number of sub-samples as the parent sample, and be distributed across assess areas identically to the parent sample. For tracking purposes, the parent/duplicate sample relationship will be recorded in accordance with sample documentation requirements stated in the governing guidance document.

Section 6
Sample Custody and Shipment

Dust samples will be kept separate from other types of media sampled (i.e., soil, air, water, building materials, insulation, etc.) and should be transported in a ridged container until the field team can relinquish custody to the sample coordinator or designated recipient.

When dust samples are be shipped to on off-site analytical laboratory, a ridged sealed container will be used. Dust samples will be shipped separated from any other types of media. The cassettes must be tightly sealed and packaged in a material free of fibers or dust to minimize the potential for contamination. Plastic bubble wrap is an example of the appropriate material for this purpose. Examples of inappropriate materials are paper and packing peanuts.

Section 7
Documentation

As required by governing guidance documents, a field logbook/PDA will be maintained by each individual or team that is collecting samples as described in this SOP. The guidance documents will detail specific conditions which require attention and documentation, but at a minimum the following information should be collected:

- Project name
- Title of governing documents
- Property address
- Date
- Time
- Team members
- Weather conditions
- Locations of any samples or sub-samples that could not be acquired
- Descriptions of any deviations to the SOP or SAP and the reason for the deviation
- Relinquishment of samples to project sample coordinator or other recipient

In addition to logbook/PDA documentation, specifics regarding details of the sample collection will be recorded as required by governing guidance documents.

Section 8
Quality Assurance/Quality Control
8.1 Equipment Maintenance

The manufacturer's instructions regarding operating procedures and maintenance will be reviewed prior to equipment use. Equipment and instrumentation will be utilized in accordance with manufacturer's instructions.

8.2 Collection of Field Quality Control Samples

Field quality control (QC) samples will consist of three types: lot blanks, field blanks, and field duplicates. The Site-Wide QAPP (CDM 2007) describes each of these samples, their corresponding acceptance criteria, and potential actions if acceptance criteria are not met. Governing guidance documents should be consulted to determine the required collection frequency for each sample type.

Section 9
Glossary

Governing guidance documents - The written document that spells out the detailed site-specific procedures to be followed by the project leader and the field personnel for completing specific investigations. These documents will clearly indicate specific requirements for the implementation of this SOP.

Sample Point - The actual location at which the dust sample is taken. The dimension of a sample point is 100 cm^2.

Composite Sampling - A sample program in which multiple sample points are compiled together and submitted for analysis as a single sample.

Libby Superfund Site - The Libby Superfund Site contains all buildings and land within the boundaries of each operable unit (OU) of the site and illustrated on the most recent version of the OU boundary map.

Section 10
References

ASTM. 2003. Standard Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Number Surface Loading. ASTM D5755-03.

CDM. 2007. Site-Wide Quality Assurance Project Plan. Draft in review.

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 8

STANDARD OPERATING PROCEDURE (SOP) FOR THE SAMPLING OF ASBESTOS FIBERS IN AIR

Prepared by: for W. Brattin (Author) Date: 3/8/01

Reviewed by: (Project Director) Date: 3/8/01

(Quality Assurance Coordinator) Date: 3/8/01

Approved by: for Paul Peronard (Project Manager) Date: 3/9/01

REVISION LOG

Revision Date	Reason for Revision
02/28/01	--
03/07/01	Further define pump calibration procedures.

PROCEDURAL SECTION

1.0 Scope and Applicability

This Standard Operating Procedure (SOP) provides a standardized method for sampling air to measure the concentration of asbestos fibers. This SOP is applicable to any type of asbestos fiber (amphibole, chrysotile) that may exist in air (either indoor or outdoor), and is applicable to both personal and ambient air (referred as stationary air throughout this SOP) sampling techniques. Filters collected in this way are suitable for examination by a variety of microscopic techniques, including TEM, PCM, and SEM.

2.0 Summary of Method

This SOP is based on air sampling techniques described in EPA SOP 2015, ISO 10312, OSHA Technical Manual, NIOSH 7400 and NIOSH 7402.

Air is drawn through a fine-pore filter in order to trap any suspended particulate matter in the air, including suspended asbestos fibers and other mineralogic materials. The filters are then examined using an appropriate microscopic technique to observe, characterize and quantify the number of asbestos fibers on the filter. The concentration of fibers in air is then calculated by dividing the total number of fibers on the filter by the volume of air drawn through the filter.

3.0 Health and Safety Warnings

Asbestos fibers are hazardous to human health when inhaled. Exposure to excessive levels may increase the risk of lung cancer, mesothelioma, and asbestosis. All personnel engaged in collection of air samples in areas where asbestos fibers may be present must have adequate health and safety training and must wear an appropriate level of personal protective equipment (PPE). Refer to the Health and Safety Plan for further details.

4.0 Cautions

None, refer to Section 3.0.

5.0 Interferences

High levels of dust or other suspended particulates may clog or overload the filter and reduce the ability to observe and characterize asbestos fibers on the filters. Precautions should be taken to avoid any unnecessary sources of dust emissions or use of aerosol sprays. Sampling conditions

(flow rate, sampling time) should be adjusted accordingly to avoid filter overload.

6.0 Personnel Qualifications

Field personnel engaged in collection of filter cassettes must be trained in the proper use and calibration of the air sampling equipment (as specified in this SOP), as well as proper methods for data recording and sample handling. Additionally, all field personnel must maintain appropriate and current training and/or certifications to meet all federal, state, and local regulations.

7.0 Apparatus and Equipment

Filter Cassettes

All samples will be collected on conductive filter holders consisting of 25-mm diameter, three piece filter cassettes having a 50-mm long electrically conductive extension cowl. The cassette shall be pre-loaded with a mixed cellulose ester (MCE) filter with pore size 0.8 um. Use of the 0.8 um pore size is recommended for all samples so that samples collected using a high volume pump are comparable to samples collected with a low volume pump. The 0.8 um pore size filters are used for samples collected with a low volume pump in order to decrease back-pressure and increase flow rate.

To reduce contamination and to hold the cassette tightly together, seal the crease between the cassette base and the cowl with a shrink band or adhesive tape. If particle deposition on the inside of the cowl is observed, it may be necessary to ground the cowl to reduce static charge. This is done by attaching one end of a length of flexible wire to the plastic cowl with a hose clamp and attaching the other end of the wire to a suitable ground (e.g., a cold water pipe).

Air Pumps

The sampling pump used shall provide a non-fluctuating airflow through the filter and shall maintain the initial flow rate within ± 10% throughout the sampling period.

A variety of different types of air pump may be used, depending on the flow rates that are required to achieve the data quality objectives and desired analytical sensitivity of the project. In general, the pump should be selected to deliver a flow rate that is as high as possible without overloading the filter with dust or fibers. The minimum flow rate is 0.5 L/min, and rates up to 10 L/min may be appropriate in some cases.

For stationary air monitors, a high volume pump that operates on AC power is recommended. For personal air sampling, either a portable high volume AC powered sampler or a low volume

battery-operated pump are acceptable, depending on whether the activities of the individual are impaired by the tethering imposed by the power cord needed for the high volume pump.

Tripod

For stationary air monitors, a tripod or other similar device is required to hold the filter cassette at a specified elevation above the floor. As noted below, this will typically be a height that represents the breathing zone (1.5-2 meters).

Spring Clips

For personal air monitors, the filter cassette is held in place using spring clips or other similar devices.

Rotameter

A rotameter that has been calibrated to a primary calibration source is required to calibrate the air flow rate at the start and the end of each sampling period. Due to its dependency on changes in atmospheric pressure, the rotameter must be calibrated to a primary calibration source at the site location (e.g., City of Libby) prior to sampling and re-calibrated on-site every week. Record calibration and re-calibration to the primary standard in the field logbook.

Primary Calibration Source

A bubble buret or other primary calibration standard may be used to calibrate the rotameter.

Sample Labels

A pre-printed sheet of sample labels (2 identical labels per sample number) is required. One label should be attached to the filter cassette before the sample collection period begins, and the matching label should be attached to the field data sheet that records relevant data on the sample being collected.

Field Log Book

A field log book is required to record relevant information regarding the collection of samples (location, time, unusual conditions or problems, etc.).

Field Data Sheet

A personal air or stationary air monitoring field data sheet (as appropriate) is required to record the relevant sampling information. Refer to the Phase 2 QAPP (EPA, March 2001) for the form.

8.0 Instrument Calibration

External calibration devices such as a bubble buret or a rotometer that have been calibrated to a primary calibration source may be used to calibrate air flow rate prior to air sampling. The flow rate must also be measured by the same method at the end of the sampling period.

8.1 Calibrating a Rotameter with an Electronic Calibrator (DryCal)

- See manufacturer's manual for operational instructions.
- To set up the calibration train, attach one end of the tygon tubing to the outlet plug of the rotameter; attach the other end of the tubing to the inlet plug on the pump. Another piece of tubing is attached from the inlet plug of the rotameter to the outlet plug on the DryCal.
- Rest or firmly stabilize the rotameter so that it is vertical (± 6°).
- Attach an isolating load with a pressure drop of about 10 to 20 inches of water column in series with a stable pump (a filter cassette of same lot number as will be used for field samples works well for this).
- Turn the DryCal and sampling pump on.
- Turn the flow adjust screw (or knob) on the pump until the desired flow rate is attained.
- Record the DryCal flow rate reading and the corresponding rotameter reading in the field logbook. The rotameter should be able to work within the desired flow range.
- Perform the calibration three times until the desired flow rate of ± 5% is attained. Once at the sampling location, a secondary calibrator (e.g., rotameter) may be used to calibrate sampling pumps.

8.2 Calibrating an Air Pump with a Rotameter

A rotameter can be used provided it has been precalibrated to a primary calibration source at the site location (e.g., City of Libby). Three separate constant flow calibration readings should be obtained both before sampling and after sampling. The mean value of these flow rate measurements shall be used to calculate the total air volume sampled.

Turn on the sampling pump and run for 5 minutes before performing calibration.

- Remove the end plugs on the filter cassette. A cassette, representative of the lot planned for use in air sampling, must be used.
- To set up the calibration train, attach one end of the tygon tubing to the cassette base; attach the other end of the tubing to the inlet plug on the pump. Another piece of tubing is attached from the cassette cap to the rotameter.

- Rest or firmly stabilize the flow meter so that it is vertical (± 6°).
- Turn the flow adjust screw (or knob) on the sampling pump until the center of the float ball on the rotameter meets the flow rate value specified in the project plan.

9.0 Sample Collection

Apply one of the pre-printed adhesive labels to the filter cassette and apply the other to the field data sheet for the sample.

Secure the filter cassette in the appropriate sampling location. For a fixed air monitor, this will generally be at a height that represents the breathing zone of the potentially exposed population (e.g., 1.5- 2 meters above the floor). For personal air monitoring, the cassette will typically be placed on the lapel just below the face of the individual being monitored. For personal air sampling for Scenarios 2 and 3 [Refer to Phase 2 QAPP (EPA March 2001)] , secure the cassette on the lapel of the dominant hand of the worker. The distance from the nose/mouth of the person to the cassette should be about 10 cm. Secure the cassette on the collar or lapel using spring clips or other similar devices. In all cases, orient the cassette so the open face of the cowel is pointing downward to avoid any particles entering the filter by precipitation. Remove the protective cap over the open face of the cowel and turn on the calibrated pump. Record the starting time, the initial flow rate, and all other relevant sample data on the field data sheet for the sample. Store covers and end plugs in a clean area (e.g., a closed bag or box) during the sampling period.

For sampling events lasting longer than 2 hours, in-field pump checks should be performed approximately every 2 hours. These periodic checks should include the following activities:

- Observe the sampling apparatus (filter cassette, pump, tripod, etc.) to determine whether it's been disturbed.
- Check the pump to ensure it is working properly and the flow rate is stable at the prescribed flow rate.
- Inspect the filter for overloading and particle deposition. Inspect the filter using a small flashlight. Look for particle adhesion or deposition on the side of the cassette and check the filter surface for accumulation of visible dust or smoke particles. If particle deposition on the inside of the cowl is observed, it may be necessary to ground the cowl to reduce static charge.

After the specified sampling period has elapsed, measure the ending flow rate and ending clock time on the data sheet. Turn off the pump and remove the cassette from the pump. Attach and secure a sample seal around each sample cassette in such a way as to assure that the end cap and

base plug cannot be removed without destroying the seal. Tape the ends of the seal together since the seal is not long enough to be wrapped end-to-end. Initial and date the seal.

10. **Sample Handling and Preservation**

Package the cassettes so they will not rattle during shipment nor be exposed to static electricity. Place custody seals, dated and marked with the packager's signature, onto the shipping container. Do not ship samples in polystyrene peanuts, vermiculite, paper shreds, or excelsior. Tape sample cassettes to sheet bubbles and place in a container that will cushion the samples in such a manner that they will not rattle. For additional shipping requirements, see the project plan.

Ship the sealed cassette to the analytical laboratory under proper chain of custody procedures. No preservation of the cassette is required.

QUALITY CONTROL and QUALITY ASSURANCE

Pre-Project Filter ("Lot") Blanks

Before samples are collected, two cassettes from each filter lot of 100 cassettes should be randomly selected and submitted for analysis. The lot blanks will be analyzed for asbestos fibers by the same method as will be used for field samples. The entire batch of cassettes should be rejected if any asbestos fiber is detected on any filter.

Field Blanks

Blank samples are used to determine if any contamination has occurred during sample handling. Prepare two blanks (from the sample lot used for field sampling) for the first 1 to 20 samples. For sets containing greater than 20 samples, prepare blanks as 10% of the samples. Filter blanks should be taken to a sampling location and prepared there. Remove the caps on the filter cassette and hold the cassette open for about 30 seconds. Close and seal the cassette as described in Section 9. Store blanks for shipment with the sample cassettes.

REFERENCES

NIOSH 7400

NIOSH 7402

ISO 10312

OSHA Technical Manual

EPA SOP 2015

Libby Standard Operating Procedure
Approved for Use at the Libby Superfund Site Only
Passive Collection of Dustfall for Asbestos Analysis (Revision 0)

Date: 05/04/05 SOP No. SRC-LIBBY-06

Title: PASSIVE COLLECTION OF DUSTFALL FOR ASBESTOS ANALYSIS

Author: Amber Graves Syracuse Research Corporation

SYNOPSIS: A standardized method is presented for collecting dustfall samples during site cleanup activities such as soil removal or building demolition. This method provides a sample that is suitable for asbestos analysis using standard techniques.

Received by QA Unit:

APPROVALS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	_____	_____
Syracuse Research Corp.	_____	_____

Revision	Date	Reason
0	05/04/2005	--

Libby Standard Operating Procedure
Approved for Use at the Libby Superfund Site Only
Passive Collection of Dustfall for Asbestos Analysis (Revision 0)

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide a standardized method for passive collection of dust fallout at indoor and outdoor locations that might be effected by site clean-up activities that release dust into air. This procedure is intended for use by employees of USEPA Region 8 and by contractors and subcontractors supporting USEPA Region 8 projects and tasks for the Remedial Investigation work performed at the Libby, Montana, Superfund site.

2.0 RESPONSIBILITIES

The Field Sampling Team Leader is responsible for ensuring that fallout samples are collected in accord with this SOP and for communicating to the appropriate USEPA Region 8 Remedial Project Manager or Regional Chemist any recommended changes or proposed improvements to the SOP.

3.0 EQUIPMENT

- Filtered, deionized (FDI) water
- Indoor collection device; Weatherproof plastic or glass cylinder, approximately 6 inches in internal diameter and 12 inches in height, with a tight-fitting lid
- Outdoor collection device; similar to indoor device, except with stand and optional windscreen (see Figures 1 and 2 in ASTM D 1739-98)

4.0 METHOD SUMMARY

This method is similar to passive dustfall collection methods used previously for asbestos analysis by Segrave (1990) and Crankshaw et al. (1995, 1999). In brief, a passive collection device is placed at the sampling location for a specified period of time. After collection, the cylinder is sealed with a tight-fitting cap and transferred to the laboratory for sample preparation as described in SOP SRC-LIBBY-07. The method is appropriate for collection of samples both indoors and outdoors.

5.0 SAMPLE COLLECTION

Dustfall samples will be collected using a passive collection device similar to that described in ASTM Method D 1739-98. The following guidelines should be followed:

- The collection cylinder should be about 6 inches in diameter and about 12 inches tall. The high aspect ratio helps minimize the escape of any particle which fall into the collection device.

- The collection cylinder must be thoroughly cleaned prior to use.

LIBBY MONTANA FIELD SAMPLE DATA SHEET

ATTACHMENT 1

FIELD DATA SHEET FOR DUSTFALL SAMPLES

Sheet No.: DF-_____

LIBBY MONTANA FIELD SAMPLE DATA SHEET

DUSTFALL

Field Logbook No: _____ Page No.: _____ Sampling Date: _____

Address: _____

Sampling Team Initials: _____

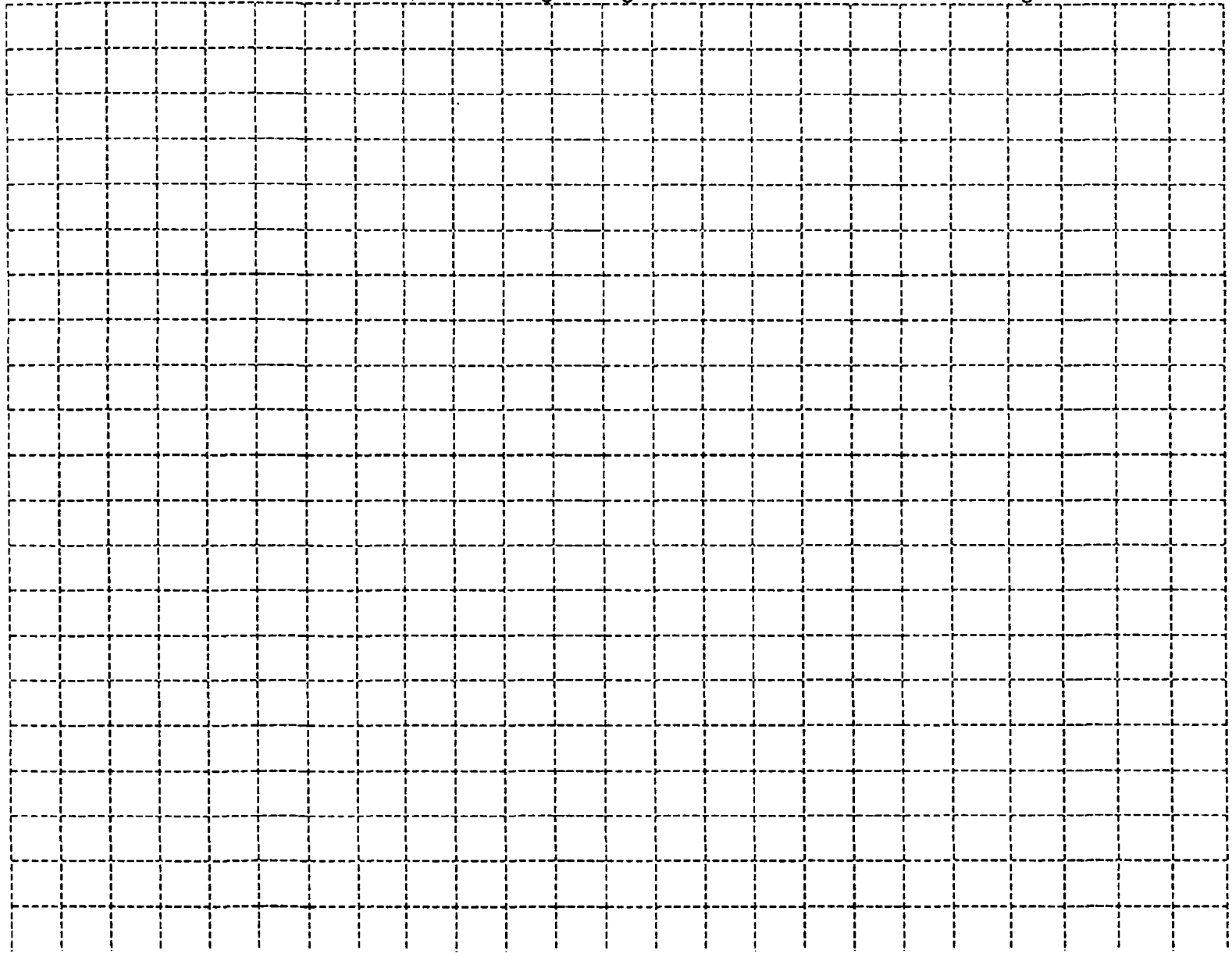
Data Item	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Sample ID					
Matrix Type (circle)	Indoor Outdoor	Indoor Outdoor	Indoor Outdoor	Indoor Outdoor	Indoor Outdoor
GPS Coordinates (outdoor only)					
Location Description (sketch on site map)					
Category (circle)	FS Blank	FS Blank	FS Blank	FS Blank	FS Blank
Start Date					
Start Time					
Stop Date					
Stop Time					
Field Comments (Note wind information in table below)					
Wind Meter ID No.					

Use back of this sheet for any additional notes or comments. Provide field sketches on the attached sheet.

Sheet No.: DF- _____

FIELD DIAGRAM OF SITE (OUTDOOR SAMPLES)

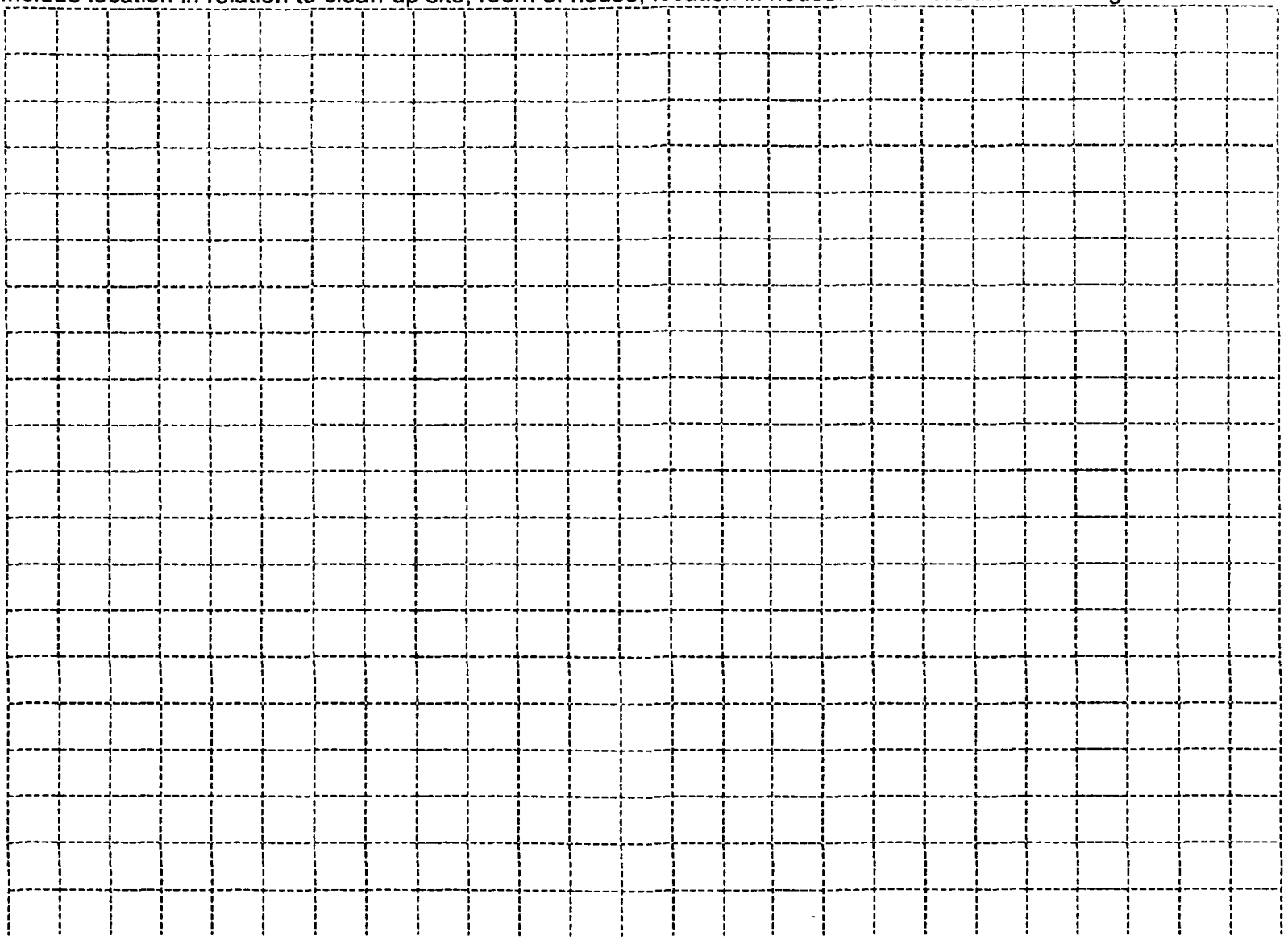
Include wind direction, sample IDs, streets, neighboring residences. Use more than one diagram if needed.



Sheet No.: DF- _____

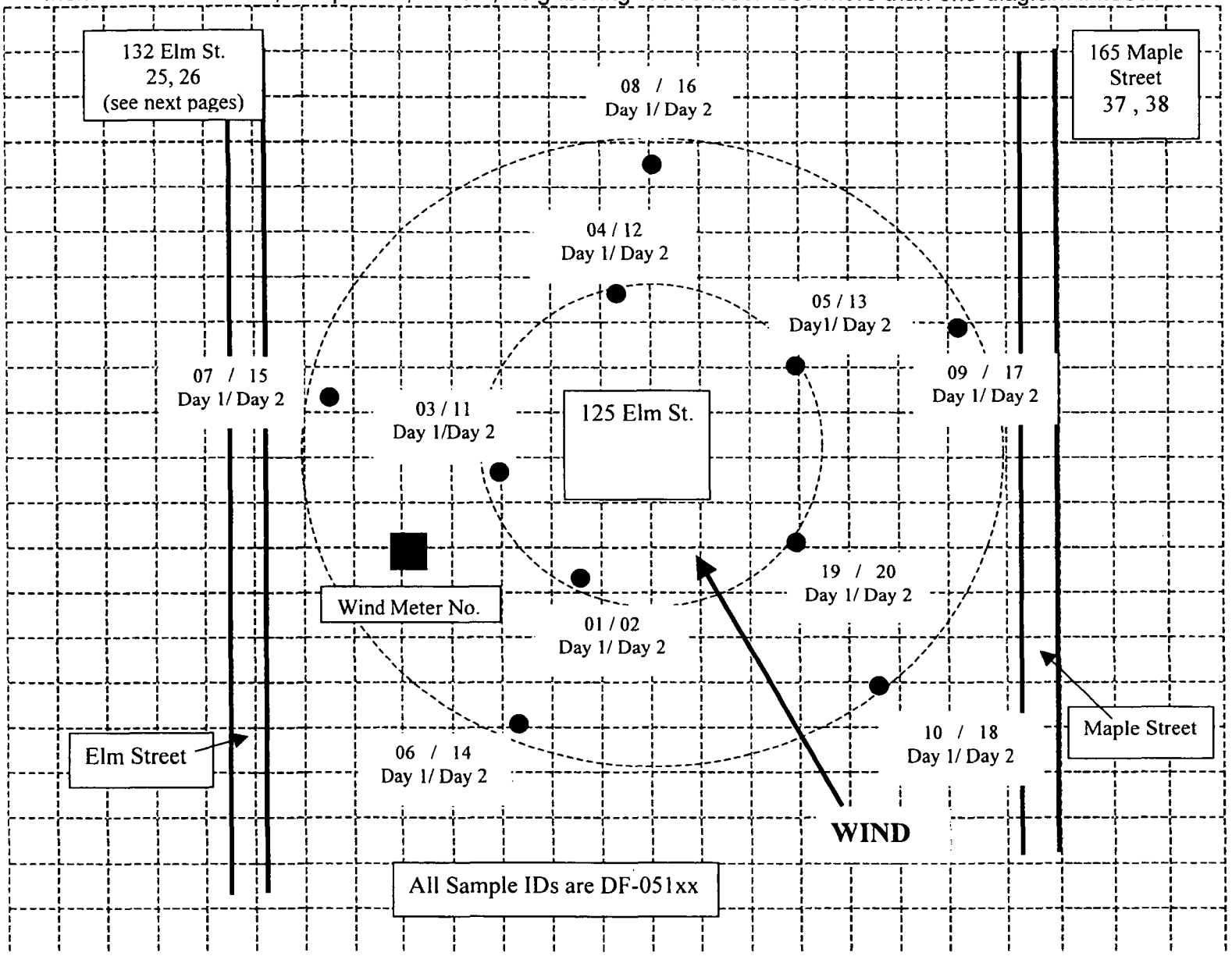
FIELD DIAGRAM OF HOUSE (INDOOR SAMPLES)

Include location in relation to clean-up site, room of house, location in house. Use more than one diagram if needed.



EXAMPLE OF FIELD DIAGRAM OF SITE (OUTDOOR SAMPLES)

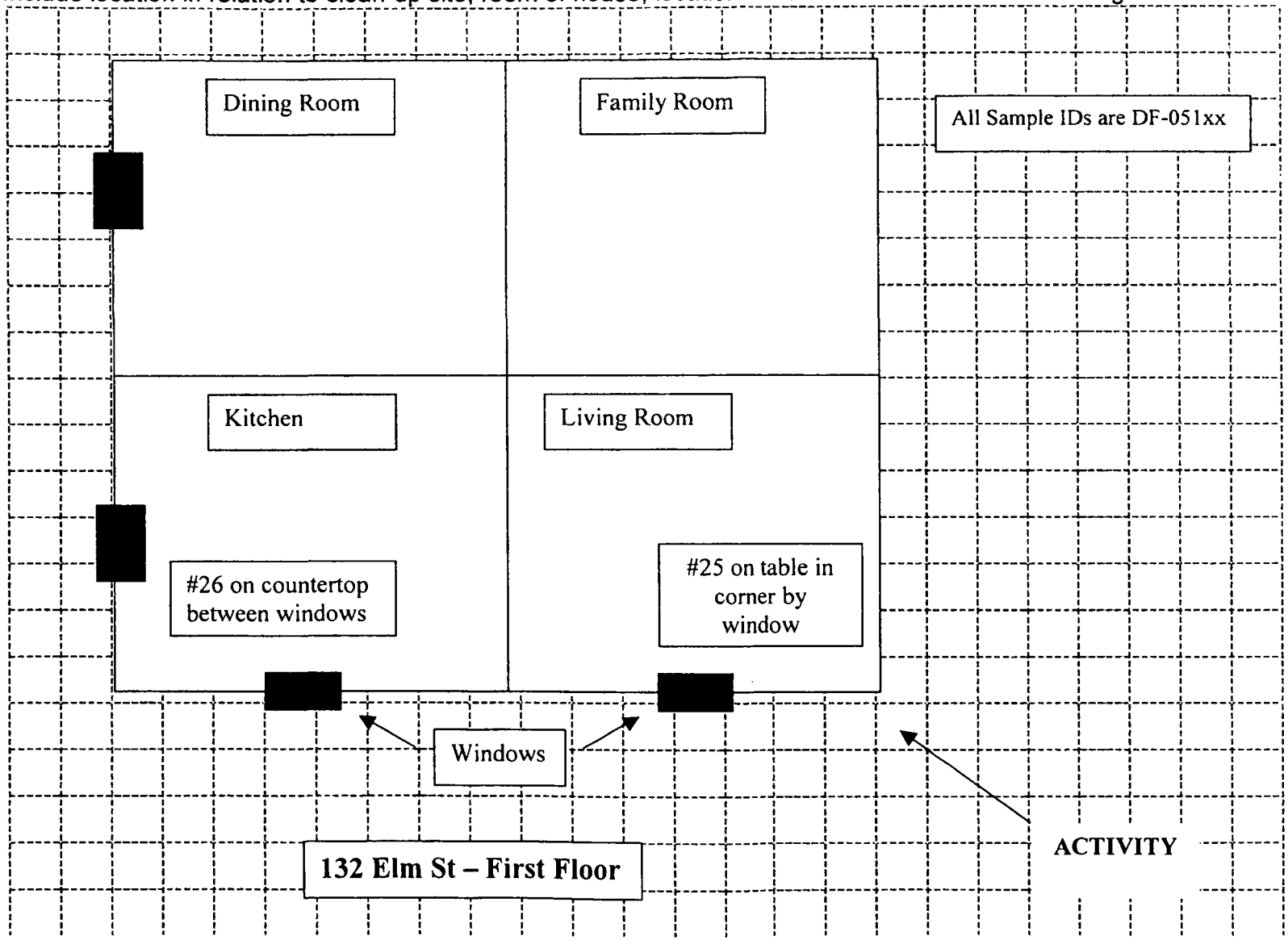
Include wind direction, sample IDs, streets, neighboring residences. Use more than one diagram if needed.



Sheet No.: DF- _____

EXAMPLE OF FIELD DIAGRAM OF HOUSE (INDOOR SAMPLES)

Include location in relation to clean-up site, room of house, location in house. Use more than one diagram if needed.



Appendix B
Field Sample Data Sheets

Sheet No.: S- 00«seq»

LIBBY FIELD SAMPLE DATA SHEET (FSDS) FOR SOIL

Field Logbook No: _____ Page No: _____ Sampling Date: _____

Address: _____ Owner/Tenant: _____

Business Name: _____

Land Use: Residential School Commercial Mining Roadway Other ( )

Sampling Team: CDM Other _____ Names: _____

Data Item	Sample 1	Sample 2	Sample 3
Index ID			
Location ID			
Sample Group			
Location Description (circle)	Back yard Front yard Side yard Driveway Other _____	Back yard Front yard Side yard Driveway Other _____	Back yard Front yard Side yard Driveway Other _____
Category (circle)	FS FD of _____ EB LB	FS FD of _____ EB LB	FS FD of _____ EB LB
Matrix Type (Surface soil unless other wise noted)	Surface Soil Other _____	Surface Soil Other _____	Surface Soil Other _____
Type (circle)	Grab Comp. # subsamples _____	Grab Comp. # subsamples _____	Grab Comp. # subsamples _____
GPS Status (circle)	Collected Previously Collected Not Collected-no signal (3 attempts) Not Collected-not required for sample	Collected Previously Collected Not Collected-no signal (3 attempts) Not Collected-not required for sample	Collected Previously Collected Not Collected-no signal (3 attempts) Not Collected-not required for sample
GPS File (fill in or circle)	Filename:_____ NA	Filename:_____ NA	Filename:_____ NA
Sample Time			
Top Depth (inches below ground surface)			
Bottom Depth (inches below ground surface)			
Field Comments *Note if vermiculite is visible in sampled area*	BD-_____	BD-_____	BD-_____
Entered (LFO) _____	Volpe: Entered _____ Validated _____	Volpe: Entered _____ Validated _____	Volpe: Entered _____ Validated _____

For Field Team Completion (Provide Initials)	Completed by:	QC by:

vs 10507

Sheet No.: PA- 00«seq»

LIBBY FIELD SAMPLE DATA SHEET (FSDS) FOR PERSONAL AIR

Field Logbook No: _____ Page No: _____ Sampling Date: _____

Address: _____ Owner/Tenant: _____

Business Name: _____

Land Use: Residential School Commercial Mining Roadway Other ( )

Sampling Team: CDM Other _____ Names: _____

Person Sampled: _____ SSN: _____ Task: _____

Data Item	Cassette 1	Cassette 2	Cassette 3
Index ID			
Location ID			
Sample Group			
Location Description			
Category (circle)	FS FB-(field blank) LB-(lot blank)	FS FB-(field blank) LB-(lot blank)	FS FB-(field blank) LB-(lot blank)
Matrix Type (circle)	Indoor Outdoor	Indoor Outdoor	Indoor Outdoor
Filter Diameter (circle)	25mm 37mm	25mm 37mm	25mm 37mm
Pore Size (circle)	TEM- .45 PCM- 0.8	TEM- .45 PCM- 0.8	TEM- .45 PCM- 0.8
Flow Meter Type (circle)	Rotometer DryCal NA	Rotometer DryCal NA	Rotometer DryCal NA
Pump ID Number			
Flow Meter ID No.			
Start Date			
Start Time			
Start Flow (L/min)			
Stop Date			
Stop Time			
Stop Flow (L/min)			
Pump fault? (circle)	No Yes NA	No Yes NA	No Yes NA
MET Station onsite?	No Yes NA	No Yes NA	No Yes NA
Sample Type	TWA EXC NA	TWA EXC NA	TWA EXC NA
Field Comments Cassette Lot Number: _____	Archive Blank (circle): Yes No	Archive Blank (circle): Yes No	Archive Blank (circle): Yes No
Entered (LFO) _____	Volpe: Entered _____ Validated _____	Volpe: Entered _____ Validated _____	Volpe: Entered _____ Validated _____

For Field Team Completion (Provide Initials)	Completed by	QC by

vs 10507

Sheet No.: D- **00«seq»**

LIBBY FIELD SAMPLE DATA SHEET (FSDS) FOR ABS DUST

Field Logbook No: _____ Page No: _____ Sampling Date: _____

Address: _____ Owner/Tenant: _____

Business Name: _____

Land Use: Residential School Commercial Mining Roadway Other ( )

Sampling Team: CDM Other _____ Names: _____

Data Item	Parameter Details
Index ID	
Location ID	
Sample Group (circle) (Subgroup of the property)	House Other_____
Location Description (circle) (Detailed description point within the location)	Basement, Ground Floor, Second Level Other_____
Matrix Type (circle)	Accessible Areas Infrequently Accessed Areas Inaccessible Areas Other_____
Category (circle)	FS FB FD of _____ LB
Sample Area (cm^2) (circle)	1,000 NA Other_____
Filter Diameter (circle)	25mm 37mm
Pore Size (circle)	TEM- 0.45 PCM- 0.8
Flow Meter Type (circle)	Rotameter Dry-Cal NA
Pump ID No.	
Flow Meter ID No.	
Start Time	
Start Flow (L/min)	
Stop Time	
Stop Flow (L/min)	
Pump Fault? (circle)	No Yes
Total Time (minutes)	
Total Flow (liters)	
Field Comments	
Cassette Lot Number: _____	Archive Blank (circle): Yes No
Entered (LFO) ____	Volpe: Entered ____ Validated ____

Location Details (circle all that apply)

Accessible – (Target 4 points)

POROUS SURFACES

1. Carpeted flooring, secondary entrance: (# of points): ____
2. Carpeted flooring, living room: (# of points): ____
3. Carpeted flooring, bedroom(s): (# of points): ____
4. Carpeted flooring, high traffic route: (# of points): ____
5. Carpeted flooring, kitchen: (# of points): ____
6. Upholstered furniture: (# of points): ____
7. Drapes or curtains: (# of points): ____
8. Other:_____: (# of points): ____

NON-POROUS SURFACES

1. Un-carpeted flooring, main entrance: (# of points): ____
2. Un-carpeted flooring, secondary entrance: (# of points): ____
3. Un-carpeted flooring, dining room: (# of points): ____
4. Un-carpeted flooring, living room: (# of points): ____
5. Un-carpeted flooring, bedroom(s): (# of points): ____
6. Un-carpeted flooring, high traffic route: (# of points): ____
7. Un-carpeted flooring, kitchen: (# of points): ____
8. Kitchen counter tops: (# of points): ____
9. Table top(s), living room: (# of points): ____
10. Table top(s), dining room: (# of points): ____
11. Table top(s), bedrooms (# of points): ____
12. Window sill(s) in living room (# of points): ____
13. Window sill(s) in dining room (# of points): ____
14. Window sill(s) in bedrooms (# of points): ____

Infrequently Accessed (Target 4 points)

1. Top of refrigerator (# of points): ____
2. Top of bookshelves (# of points): ____
3. Shelves of bookshelf (# of points): ____
4. Top of hot water heater (# of points): ____
5. Beneath furniture in living room (# of points): ____
6. Beneath furniture in bedrooms (# of points): ____
7. Inside kitchen cabinets (# of points): ____

Inaccessible Areas (Target 2 points)

1. Beneath heavy appliances (# of points): ____
2. Forced air vents in main living room (# of points): ____
3. Forced air vents in bedrooms (# of points): ____
4. Corner of small areas (# of points): ____

Field Team Completion (Initials)	Completed by	QC by

vs 051507

Appendix C
Libby Asbestos Project Record of Modification Form

Record of Modification

to the

Libby Sampling and Quality Assurance Project Plan

Field Activities

LFO-0000__

Instructions to Requester: **Fax to contacts at bottom of form for review and approval.**
File approved copy with Data Manager at the Libby Field Office (LFO).
Data Manager will maintain legible copies in a binder that can be accessed by LFO personnel.

Project QAPP (circle one): Phase I (approved 4/00) Phase II (approved 2/01)
Removal Action (approved 7/00) Contaminant Screening Study (approved 5/02)
Other (Title and approval date):_____

SOP (Number and Revision No.):_____
_____

Other Document (Title, Number/Revision): _____

Requester: _____ Title: _____
Company: _____ Date: _____

Description of Modification (attach additional sheets if necessary; state section and page numbers of SQAPP that are affected by the proposed modification):_____
_____
_____

Field logbook and page number where Modification is documented (or attach associated correspondence):
_____

Potential Implications of Modification: _____
_____
_____

Duration of Modification (circle one):
Temporary Date(s):_____
Resident address(es): _____
_____
- If appropriate, attach a list of all applicable Index Identification numbers.

Permanent (Proposed Text Modification Section) Effective Date:_____

Proposed Text Modifications in Associated Guidance Document (attach additional sheets if necessary):____
_____
_____

Data Quality Indicator (circle one) – Please reference definitions on reverse side for direction on selecting data quality indicators:

Not Applicable **Reject** **Low Bias** **Estimate** **High Bias** **No Bias**

Technical Review and Approval: _____ Date:_____
(Volpe Project Manager or designate)

EPA Review and Approval: _____ Date:_____
(USEPA RPM or designate)

DATA QUALITY INDICATOR DEFINITIONS

Reject - Samples associated with this modification form are not useable. The conditions outlined in the modification form adversely effect the associated sample to such a degree that the data are not reliable.

Low Bias - Samples associated with this modification form are useable, but results are likely to be biased low. The conditions outlined in the modification form suggest that associated sample data are reliable, but estimated low.

Estimate - Samples associated with this modification form are useable, but results should be considered approximations. The conditions outlined in the modification form suggest that associated sample data are reliable, but estimates.

High Bias - Samples associated with this modification form are useable, but results are likely to be biased high. The conditions outlined in the modification form suggest that associated sample data are reliable, but estimated high.

No Bias - Samples associated with this modification form are useable as reported. The conditions outlined in the modification form suggest that associated sample data are reliable as reported.

Appendix D
Analysis of Asbestos in Dustfall Samples by TEM
SRC-LIBBY-07

Libby Standard Operating Procedure
Approved for Use at the Libby Superfund Site Only
Analysis of Asbestos in Dustfall Samples by TEM (Revision 0)

Date: 05/04/05 SOP No. SRC-LIBBY-07

Title: ANALYSIS OF ASBESTOS IN DUSTFALL SAMPLES BY TEM

Author: Amber Graves Syracuse Research Corporation

SYNOPSIS: A standardized method is presented for measuring asbestos concentrations in dust released to air during site cleanup activities such as soil removal or building demolition. This method is adapted from methods ASTM D5755-95 and ISO 10312.

Received by QA Unit:

APPROVALS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	_____	_____
Syracuse Research Corp.	_____	_____

Revision	Date	Reason
0	05/04/2005	--

Libby Standard Operating Procedure
Approved for Use at the Libby Superfund Site Only
Analysis of Asbestos in Dustfall Samples by TEM (Revision 0)

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide a standardized method for transmission electron microscope (TEM) analysis of asbestos in samples of dust collected by a passive fallout collector as described in SOP SRC-LIBBY-06. This procedure is intended for use by employees of USEPA Region 8 and by contractors and subcontractors supporting USEPA Region 8 projects and tasks for the Remedial Investigation work performed at the Libby, Montana, Superfund site.

2.0 RESPONSIBILITIES

The Laboratory Director is responsible for ensuring that fallout samples provided to the laboratory for evaluation are handled and evaluated in accord with the requirements of this SOP, and for communicating to the appropriate USEPA Region 8 Remedial Project Manager or Regional Chemist any recommended changes or proposed improvements to the SOP.

3.0 EQUIPMENT

- Filtered, deionized (FDI) water - sample suspension medium
- Clean 500 mL graduated cylinder
- Filter apparatus, glass or disposable
- 25-mm or 37-mm diameter cellulose ester (MCE) filters with 0.45 um or smaller pore size
- Tweezers - MCE filter preparation for TEM
- Scalpel blade - MCE filter preparation for TEM
- Dimethylformamide/acetic acid mixture - MCE filter preparation for TEM
- Micropipette with disposal tips - MCE filter preparation for TEM
- Plasma etcher -MCE filter preparation for TEM
- Carbon coater - MCE filter preparation for TEM
- Jaffe washer - MCE filter preparation for TEM
- Acetone vapor generator- MCE filter preparation for TEM
- TEM- 80 to 120 kV transmission electron microscope (TEM), capable of performing electron diffraction with a fluorescent screen inscribed with calibrated gradations, is required. The TEM must be equipped with energy dispersive X-ray spectroscopy (EDS) and it must have a scanning TEM (STEM) attachment or be capable of producing a spot size of less than 250 nm in diameter in crossover. The microscope must be calibrated and maintained according to the requirements described in NVLAP Airborne Asbestos Program.

4.0 METHOD SUMMARY

Samples of dust fallout will be provided to the laboratory in capped collection cylinders that are about 6 inches in diameter and about 12 inches tall. The cylinders will contain a

layer of water in the bottom to help ensure that all particles which entered the cylinder are retained. At the laboratory, the contents of the cylinder will be collected onto an MCE filter by vacuum filtration. This filter is then prepared and examined for asbestos structures by TEM in basic accord with ISO 10312. The units of the results may be expressed either as total asbestos fallout (s/cm^2) or as a rate of fallout (s/cm^2/hr).

5.0 SAMPLE PREPARATION AND ANALYSIS

5.1 Sample Filtration

Pour the water from the collection cylinder into a clean 500-mL graduated cylinder. Rinse the container thoroughly with FDI water and collect the rinsate in the graduated cylinder. Add additional FDI water to a final volume of 500 mL. Thoroughly mix the 500 mL sample by hand-inverting 10 times.

Remove 250 mL of the sample suspension and filter through a 25 mm or 37 mm MCE filter (0.45 um or smaller pore size) using a disposable filter funnel. If the dust loading on the filter is too heavy, prepare a second filter using a smaller volume.

5.2 TEM Filter Preparation

Prepare at least two grids from the filter for examination by TEM in accord with the standard methods described in International Organization for Standardization (ISO) method 10312, except where specifically indicated in this method or where appropriate project-specific laboratory modifications are necessary.

5.3 Counting Rules

Counting rules are the same as described in ISO 10312, except that all asbestos structures 0.5 um in length and with an aspect ratio of at least 3:1 should be recorded. Target sensitivity and appropriate stopping rules should be specified in the workplan or QAPP/SAP developed for the project.

6.0 COMPUTATION OF RESULTS

The amount of asbestos in dust fallout during a sampling period is calculated using the following equation:

$$AFO = \frac{N \cdot EFA}{GO \cdot Ago \cdot A \cdot F}$$

where:

AFO = Asbestos fallout (structures / cm^2)
N = Number of countable asbestos structures observed
EFA = Effective filter area (mm^2)

GO = Number of grid openings examined
Ago = Area of one grid opening (mm^2)
A = Area of collection cylinder (cm^2)
F = Fraction of original sample applied to filter

If the number of asbestos structures observed is zero, the results should be reported as less than the analytical sensitivity , where sensitivity is given by:

$$S = \frac{EFA}{GO \cdot Ago \cdot A \cdot F}$$

For convenience, all of these calculations are performed automatically by the electronic analytical data recording sheet (Attachment 1).

Asbestos fallout rate (AFR) is computed from AFO as follows:

AFR = AFO / Collection time (hr)

7.0 QUALITY ASSURANCE

Laboratory blanks should be prepared and analyzed in accord with standard laboratory practice. If asbestos contamination is detected on a laboratory blank sample, the laboratory director should take immediate steps to identify and address the source of the contamination before any further field samples are analyzed.

8.0 DOCUMENTATION

All analytical results for each sample should be recorded using the standard electronic data sheet provided in Attachment1.

9.0 REFERENCES

American Society for Testing and Materials. 1995. Standard Test method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Number Concentrations. ASTM Method D 5755-95.

International Organization for Standardization. 1995. Ambient air -- Determination of Asbestos Fibres -- Direct Transfer Transmission Electron Microscopy Method. ISO Method 10312.

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ATTACHMENT 1

Electronic Datasheet for Recording Analytical Results

TEM.xls
(Check with Volpe or SRC to determine the most recent version number)